ENGINEERING
NEWS-RECORD

Jan. 24, 1957

A Staff Report on:

Construction's $100 Billion Challenge

Because the road program represents the biggest peacetime expenditure in the nation's history; because roads generate every other type of construction; and because this means better living for all and a stronger nation, the bulk of this issue is devoted to the problems and the prospects which the program poses. For roads are everybody's business.

Also, A Special Study on . . .

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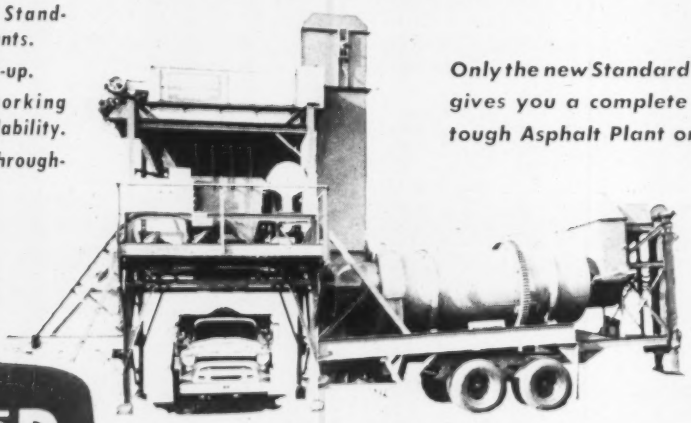

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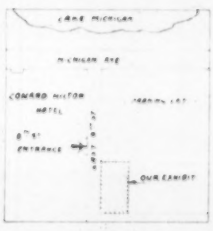

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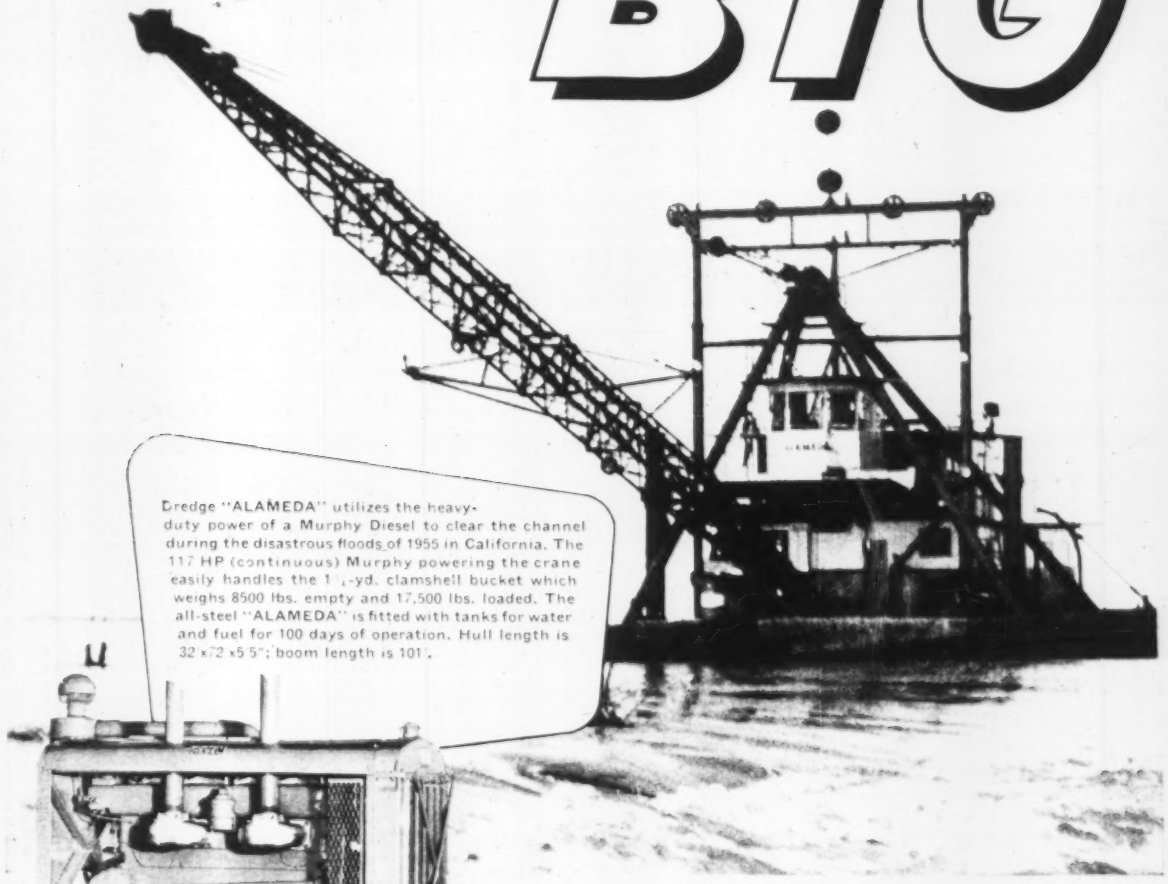

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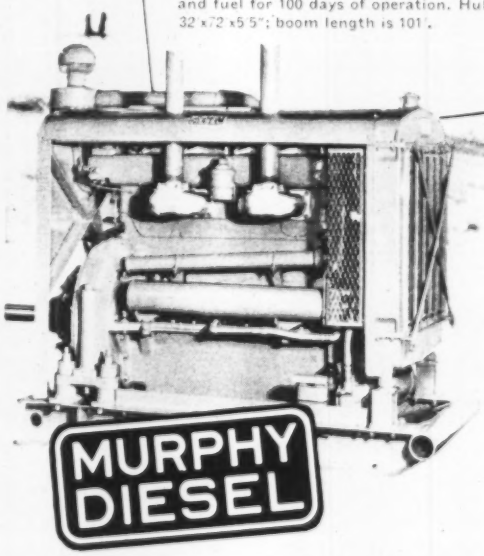

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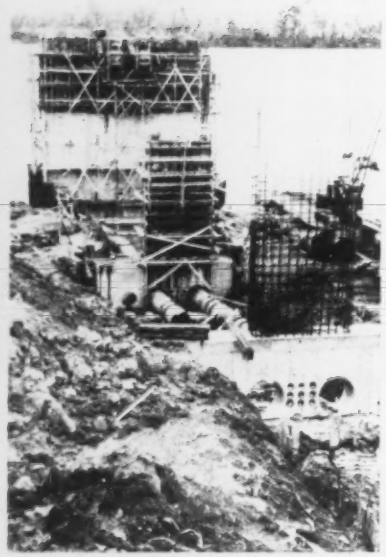

Symons Forms used on Ohio River Intake Job . . .

60,000 square feet of concrete forming went into this job constructed for the city of Henderson, Kentucky. The wall started at elevation 317 (sea level elevation) or 21 feet below the river pool stage and when completed was topped at 385 or 47 feet above the water.

15,000 square feet of Standard Symons Wood Frame Forms were used, in sizes 2' x 4', 2' x 6' and 2' x 8'.

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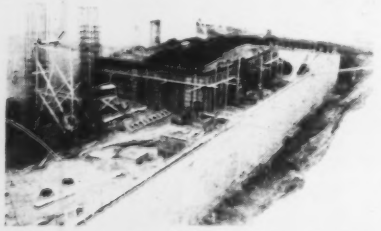

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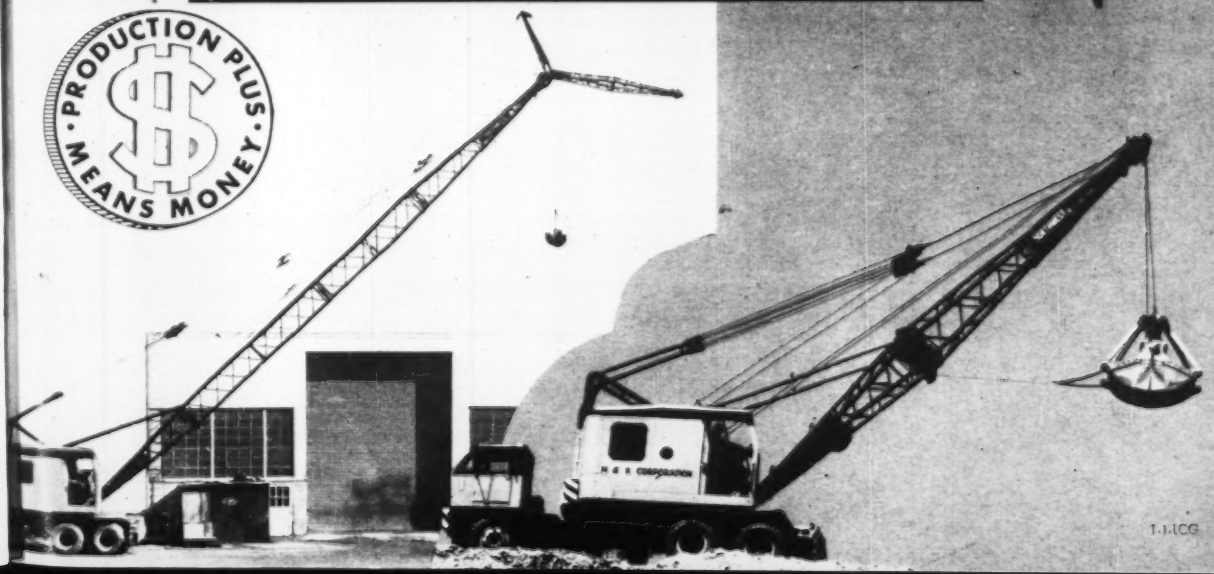

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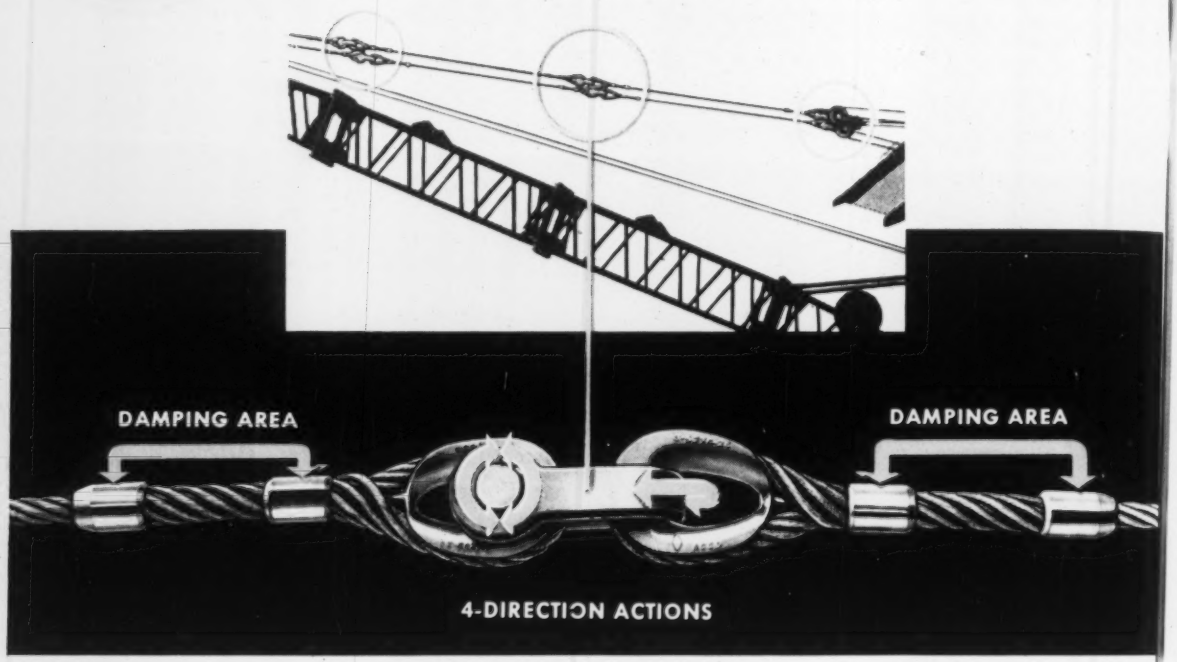

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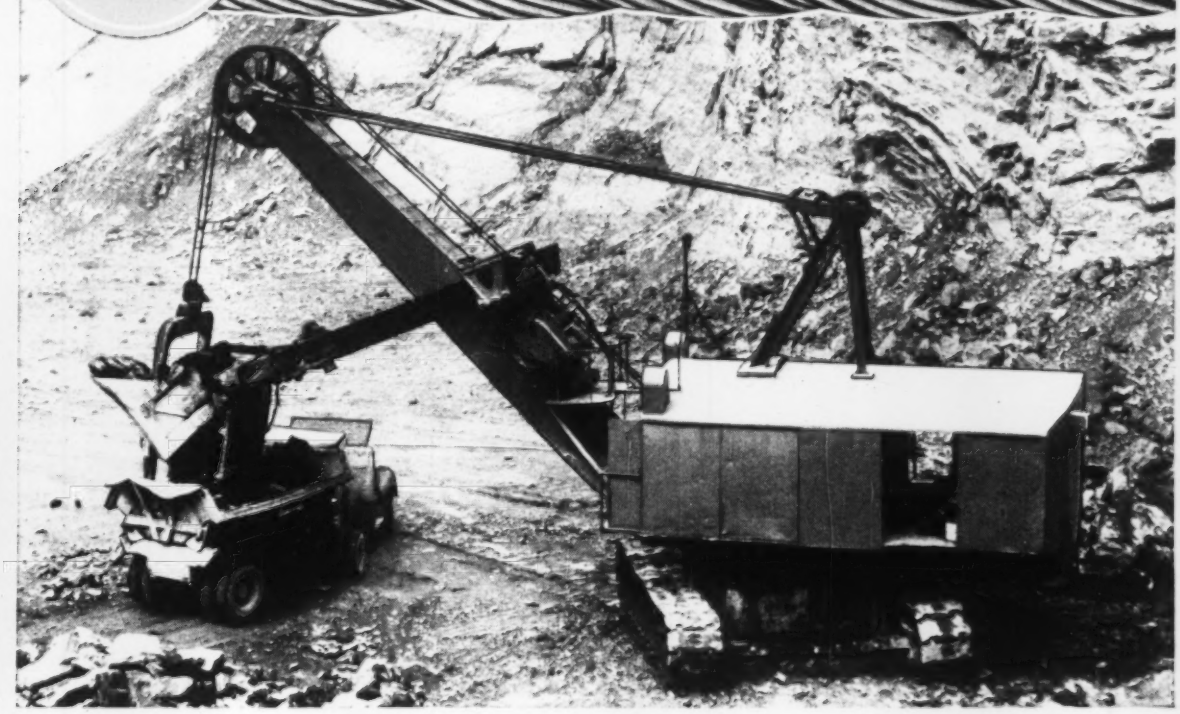

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Lester Van Alystyane, Superintendent of The Callanan Road Improvement Company, Kingston, New York says: "Quarrying operations are rough on shovel hoist ropes. The best Improved Plow Steel shovel hoist ropes we could buy for our 120-B Bucyrus-Erie shovel used to last for about 250 thousand tons of rock. When we switched to new **TRU-LAY VHS** the life of our ropes jumped over one-third—now we get 325 to 350 thousand tons per rope.

"The new **VHS** seems to take the shocks better than any other rope we have used. And it saves us money on 'down time' and loss of production."

New **VHS** is setting new records like this in hundreds of applications—as shovel hoist ropes, scraper and dozer cables and draglines. Made from a new grade of steel for wire rope, it is at least 15% stronger than IPS—the strongest grade formerly available.

Handle Heavier Loads—With Higher Safety Factor

This extra strength means you can safely handle heavier loads with the same diameter line. And you get a higher factor of safety during the entire period of operation.

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And, in addition to its greater strength, new **TRU-LAY VHS** is tougher. It was developed especially for the toughest applications—draglines, shovel hoist ropes, scraper and dozer cables. It thrives under the abuse wire rope necessarily gets in these punishing services.

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Because it is stronger and tougher, new **VHS** lasts longer in these tough applications. This saves money. And you make additional savings by reducing the amount of "down time" necessary for wire rope replacement.

Your American Cable distributor has draglines, shovel hoist ropes and scraper and dozer cables of new **TRU-LAY VHS** in stock now. You don't need any complicated specifications to order them. Just call him today and tell him the size and diameter you want.

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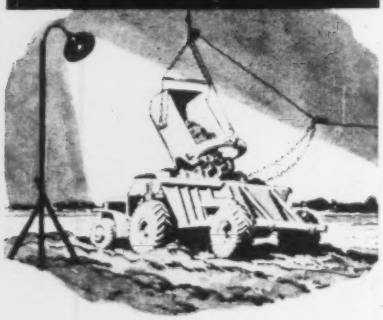

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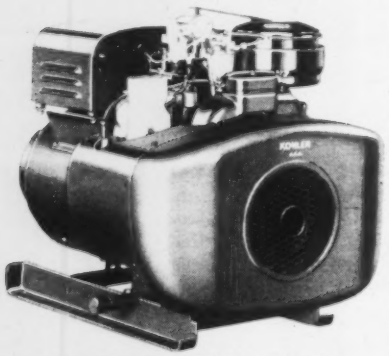

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Reader Comment

Asphalt Sturdier

SIR—I was interested in your editorial "Sturdier Asphalt Runways" in the November 15 issue. From your resume it appears that the rutting took place entirely in a 5 in. asphaltic surfacing and not in the base material.

Many years ago on the Pacific Coast we had to meet the problem of asphaltic types with comparatively high temperature susceptibility, hence a tendency of pavements to deform at summer temperatures beyond that of roads built with Eastern and other asphalts of more temperature stability. The problems of unsatisfactory stability under normal stress and with temperature-susceptible asphalts, and that of unsatisfactory stability with high stresses and lower temperature susceptibility, are mechanically exactly the same.

The State of California, through the researches of Mr. F. N. Hveem and his colleagues, solved the problem by controlling (a) the stability of the aggregates in bases as such; (b) the asphalt content; (c) the thickness of the asphaltic surface.

Point (a) revolved on determining the *minimum* asphalt content at which the pavement would have satisfactory cohesion; it was established that the stability under standing loads of such a pavement was simply that of the aggregate, lessened by the lubricating effect of the asphalt, and that this effect increased with increasing asphaltic content, especially as the pavement became compacted through the years by traffic.

The function of the asphalt is not to add internal stability under vertical loading to the mix, but to add stability to the whole structure by supplying a panel or beam action under *dynamic* loading. The effectiveness of this panel action increases with asphalt content while the internal stability of the mix itself decreases; hence the science of satisfactory design depends on adding as much asphalt as possible without unduly decreasing the internal stability of the mix.

The optimum asphalt content for static stability—as measured by the stabilometer used here—will almost without exception be less than that indicated by any test method which primarily measures cohesion.

Point (b) of course depends on reliable measurement of the stability of aggregates, which cannot be tested directly except by a triaxial method of some kind, such as the stabilometer mentioned.

In regard to Point (c) as shown by the paper presented to ASTM by the undersigned in 1940, given a base material of higher stability than the paving mix itself, the rutting tendency of the mix increases with increasing thickness.

In this area, five inches of thickness is very high. It is correct design to use as thick an asphaltic surfacing as is possible and economical, in order to increase the panel action mentioned; but it must be controlled by the principle of decreasing stability with increasing thickness. In Contra Costa County we have many roads under major traffic, constructed with only 1½" thickness of asphalt surfacing on well controlled bases, serving satisfactorily. The greatest thickness we use is 3 in. and most often 2½ in. on main roads.

It is better economy and technical practice to use a rather lean, rather thin asphaltic concrete or plant mix surface, and put the asphalt saved into beefing up the base aggregates and the panel action to considerable depth with a lean asphalt content, thus taking full advantage of a bituminized base which would not carry traffic itself without raveling, but serves very effectively under a surface of higher asphalt content.

The writer notes that exactly that change was made between the first and second sections of the the Maine Turnpike; the first construction was of 7½ in. asphaltic concrete on a 30 in. granular base; the second was 3 in. asphaltic concrete on 4 in. penetration macadam over 13 in. select gravel base plus 20 in. improved subgrade. This change accorded the fundamental principles; though in this area a special plant mix would probably have been used instead of the penetrated base.

Since the stress on the granular base materials decreases very rapidly with depth, the quality of base materials, hence the unit cost, can be decreased rapidly with depth. Thus in this county, and in California and the West Coast in major part, the principles are: (1) a carefully proportioned, thin (1 in. up but seldom over 5 in.) asphaltic concrete or plant mix base; (2) an equally carefully tested, rather thin,

(*Reader Comment continued on p. 14*)

Engineering News-Record welcomes expression of opinions from its readers. Comment should be as brief as possible and pertinent to subjects of current construction importance. Letters should be addressed Editor, Engineering News-Record, 330 W. 42nd St., New York 36, N. Y.

CATERPILLAR

THE ROAD AHEAD

America's new highway program is a 50-billion-dollar challenge to the nation's road builders. Success of the greatest building project ever conceived by man rests with them alone

America has handed the new Federal-aid highway building program to the nation's road builders with complete confidence.

In the next 13 years, the U.S.A. will spend 50 billion dollars building Federal-aid roads alone. From the program will rise a magnificent 41,000-mile system of Interstate Freeways. It totals up to the greatest building project in history.

Only this nation could have the vision for such a program. For only America has the need for it . . . and the resources to see it through to completion. And only America—unawed by bigness—could start such a program without a doubt of its success . . . a magnificent tribute to the nation's road builders.

But make no mistake about it. This is a 50-billion-dollar challenge. It will take co-ordination, co-operation, and the combined experience of the nation's contractors, engineers, Federal and State road officials, bankers, material producers and equipment manufacturers. They start with the nation's confidence. Will they be able to hold it on the long road ahead? The next two pages will give you a clue.

CONTINUED

ROAD BUILDERS RISE TO THE CHALLENGE BY WORKING TOGETHER AS NEVER BEFORE

The key to America's fabulous road-building program is co-operation. The men who must make it work are a diversified group—bankers, engineers, contractors, government officials, materials producers, equipment manufacturers. But they are united today by *one goal* and are setting an example of industry co-operation rarely equaled. Here are some examples of how an equipment manufacturer is co-ordinating its activities with all other groups.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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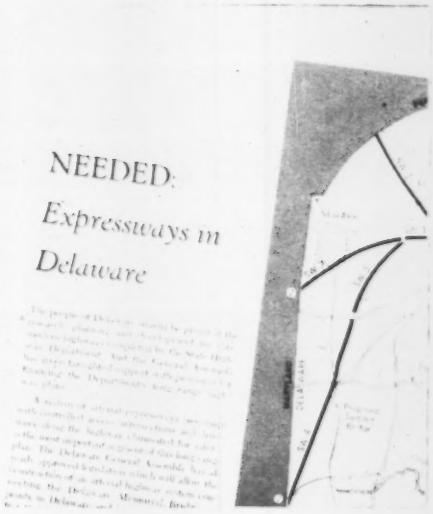
BANKERS AND EQUIPMENT MANUFACTURERS. Some 180 bankers from every sector of the U.S.A. view the latest earthmoving equipment at the world-famous Caterpillar proving ground in Peoria. A two-day program gives them a close-up of new and improved CAT* equipment—like the giant D9 and the new DW21 with its high-capacity LOWBOWL Scraper—which they finance for contractors. A show like this bolsters confidence—makes credit easier.

STATE OFFICIALS AND EQUIPMENT MANUFACTURERS. This Caterpillar leaflet helped road officials in Delaware get important limited access legislation approved. Caterpillar first featured Delaware in a national advertisement, then local Caterpillar Dealers sent reprints like this to legislators and other interested persons in the state explaining the need for limited access legislation. Bill passed soon after.



CONTRACTORS, GOVERNMENT OFFICIALS, MATERIALS PRODUCERS AND EQUIPMENT MANUFACTURERS. The 1957 Road Show in Chicago this month will demonstrate to contractors, government officials and materials producers that the equipment is ready for the job ahead. Caterpillar's exhibit will feature the new road program in detail and will spotlight the machines on which contractors will depend to accomplish the job.

ENGINEERS AND EQUIPMENT MANUFACTURERS. Exhaustive on-the-job tests are made on newly designed equipment to help engineers figure capacity, speed of production. Engineers base their estimates and contracts on the known production capabilities of machines—they depend on those machines to perform with minimum down time. Here the Caterpillar DW21 Tractor with No. 470 LOWBOWL Scraper helps meet the engineers' challenge on the Florida Turnpike.

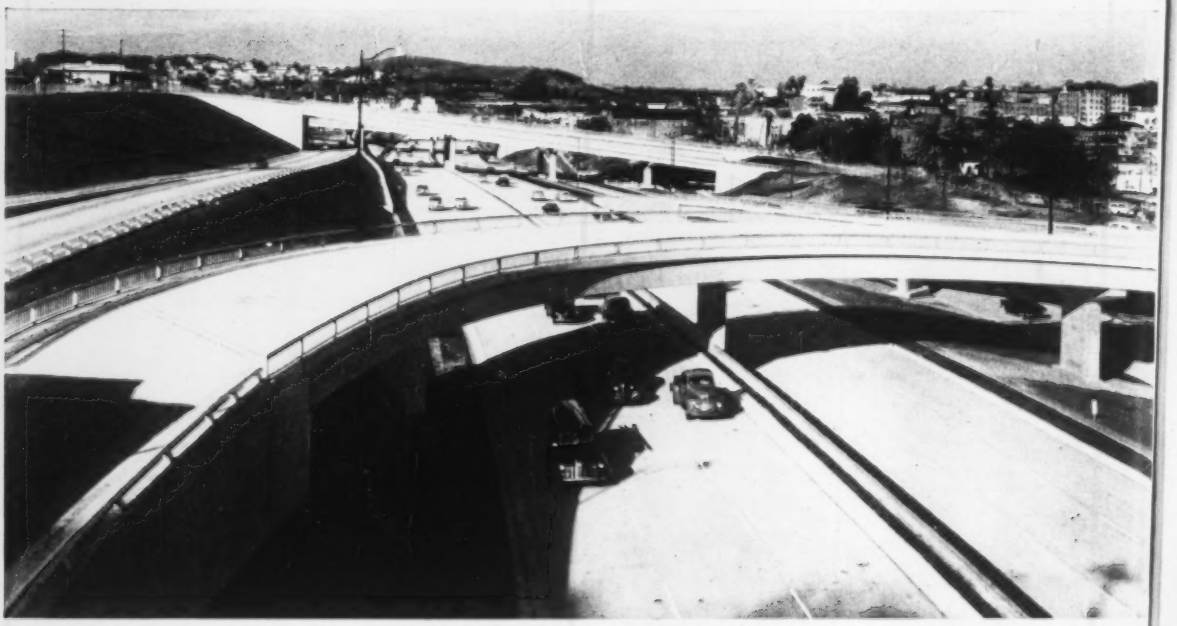
REINFORCED CONCRETE

high-speed expressways start quicker ... are completed sooner

From coast to coast, highway engineers are finding that reinforced concrete bridges start quicker because all necessary materials and labor are readily available from local sources. These faster starts, made possible with reinforced concrete, save months of delay.

Furthermore, reinforced concrete is a flexible medium that permits an infinite variety of imaginative and graceful designs. You can design multiple overpass bridges with bold, dramatic lines and soaring curves. Structures built with reinforced concrete are rugged . . . highly resistant to wind, shock, and quake. They are lower in first cost and require less maintenance.

On your next bridge or overpass, design for rugged beauty plus economy . . . design for REINFORCED CONCRETE.



Overcrossing located in downtown Los Angeles carrying local city traffic across the Harbor Freeway, U.S. Highway 6.

Designed by the California Division of Highways

Contractor: Winston Bros., Monrovia, California

CONCRETE REINFORCING STEEL INSTITUTE

38 South Dearborn Street, Chicago 3, Illinois

NEW THOR SELF-PROPELLED ONE-MAN DRILLCAT

First on-the-job reports prove Drillcat delivers more work, bigger profits, in less time

CHECK THIS PROOF DIRECT FROM THE JOB

PAID FOR ITSELF IN ONE JOB

A net profit of $15,000 in one week on rock drilling jobs was reported by one contractor—another, equipped with five Thor Drillcats paid for them in three months from extra profits.

SAVES OVER 2½ HOURS SET-UP TIME

You can set a Thor Drillcat in drilling position—ready to go—in 20 to 25 minutes.

FAST WHEN THE GOING IS TOUGHEST

One man on a Drillcat tugged a 600 c.f.m. air compressor ½ mile over rough terrain, drilled five holes and was back with equipment at his starting point in only two hours.

DRILLING TOE HOLES. The Thor Drillcat is completely flexible. The boom and mast are lowered flat to the ground for toe and lifter holes. Twin reversible drive air motors permit easy maneuvering to any position, any angle. (Note position of controls for easy operation.) A "dead man" control for all air valves is standard equipment on the Drillcat.

DRILLING DOWN HOLES. Two 7½ h.p. air motors propel this compact (6 ft. 9 in. overall) Thor Drillcat where no other crawler can go. More than enough power to pull its own air supply. Drilling down holes is no chore for Thor's Drillcat. Using the powerful model 105M drifter and chain feed mast, the hydraulic accumulator keeps boom rigid at all times. This means less steel breakage and less wear on chuck parts.

These exclusive features make Thor model MM-2 Drillcat the most productive rock-drill you can buy! Ask any Thor distributor for a Drillcat demonstration.

● **Thor's super-powered 105M drifter rock drill.** ● **Rugged Thor BW-2 wagon drill mast and air control motor.** ● **Self-propelled with two 7½ h.p. Eimco air motors, power aplenty to haul itself and air supply.** ● **Rigid frame, proved in tractor design, no moving or wearing parts, long lasting, low maintenance.** ● **Aircraft-type accumulator in hydraulic system absorbs shock.** ● **Simple hand-operated track take-up. No tools required. No track locks required.** ● **Large flat platform. Ideal for operator when drilling toe holes, good for tool and fuel storage.**

VISIT THOR EXHIBIT, ARBA SHOW
Booth 706, Section D, International Amphitheatre
Chicago, January 28 through February 2

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PORTABLE POWER
TOOLS

THOR POWER TOOL COMPANY
Aurora, Illinois
Branches in all principal cities

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MODEL 510

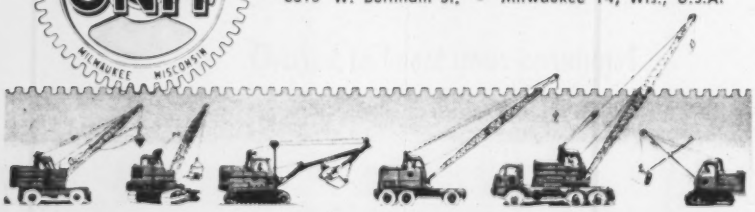
THE NEW UNIT Challenger ...with CLAMSHELL

It's BEST to INVEST in UNIT...

because UNIT's advanced design gives you **Self-Aligning, Replaceable Hook Shoes . . . Straight-in-line Engine Mounting with Torque Converter . . . Hydraulic Actuated Clutches . . . Modern Transmission with Involute Splines . . . One Piece Cast Gear Case . . . Alloy Steels and Forgings . . . Force Feed Lubrication** and many other UNIT advantages. These life-prolonging features are contributing substantially to the performance and efficiency of each machine. And they explain why UNIT equipment is so universally acceptable.

See the many other new features illustrated and described in UNIT CHALLENGER Bulletin C-800. Write for your copy of this bulletin.

UNIT CRANE & SHOVEL CORP.
6315 W. Burnham St. • Milwaukee 14, Wis., U.S.A.



granular base (6 in. to 8 in.), and successive layers (usually only one in our case) of granular, most often sandy materials of quality decreasing with depth. The bituminous stabilization of a layer of granular materials under the asphaltic concrete, as with the second section of the Maine Turnpike, would follow the same principal, but for Contra Costa County traffic, it is not justified.

The principles governing highways and runways are the same. Your editorial states that the Flexible Pavement Laboratory and the Asphalt Institute think it will only be a matter of time until the problem is solved.

The writer has the same opinion; but also thinks that the solution will have to follow the principles set forth above. He also believes that these principles have been rather masked in the past, in Eastern and Midwest practice, by the use of asphalts having such high temperature resistance that the problem never came to a head under highway traffic; and also masked by the use of test methods — Hubbard-Field, Marshall, etc. which placed the main emphasis on cohesion rather than granular stability.

Such tests need to be supplemented by tests bringing out differences in such stability; and it will almost invariably be found that the optimum asphalt content for that stability is 1% to 2½% less than for cohesion. (For instance 5% of asphalt, by weight of aggregate, as against 6% to 7½%.)

In summing up, it appears that Eastern highway traffic just never was caught up with by this problem—at least until recently—because of the difference in type of asphalts; but that military runway traffic, and perhaps turnpike highway traffic, now have met it. We met it sooner here and hence determined the principles sooner. The writer has met with Eastern engineers who found it difficult to believe that good roads could be built with California asphalts. From the Air Force ruling it appears that some engineers have difficulty in believing that good runways can be built with asphalts, period. "Same difference," as the saying goes. Same solution, basically.

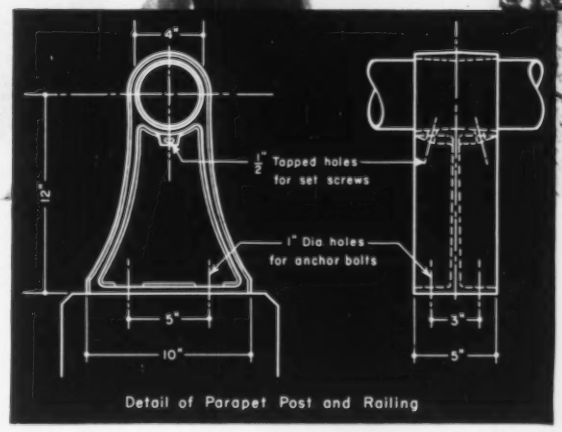
Yours very truly,
V. A. Endersby
Materials and Testing Engineer
Contra Costa County Public Works Dept.
Martinez, Calif.

A Fluoridation Foe

Sir—On the editorial page of ENR Dec. 27, there appeared "Fumbling with Fluoridation." I wish to comment, if I may, realizing that it won't

(Continued on p. 17)

Beesleys Point, N.J. Bridge on Garden State Parkway
Contractor and Erector: Ole Hansen



Detail of Parapet Post and Railing

New Light-Weight Bridge Rail:

A FLYNN ALUMINUM EXTRUSION

This picture was not taken just for effect. Its purpose is to demonstrate that a single workman could have installed the bridge rails on this Garden State Parkway construction job. That's because the rails are light-weight Aluminum—extruded by Flynn for faster, easier, less costly installation. Gone are the usual expenses of cranes, lift-trucks, over-manned crews. No wonder Flynn Aluminum railings save time and money for construction companies.

FLYNN: HEADQUARTERS FOR ALUMINUM BRIDGE-RAIL

Rails and posts . . . engineered for maximum structural strength with minimum material . . . produced by Flynn. The day will never come that they'll need a coat of paint, show signs of rust, require replacement or costly maintenance. Whether you want a custom designed profile, or one of the many dies in stock at Flynn, you can count on top-drawer service, delivery *on schedule*. On your next order, learn how easy and profitable it can be to work with light-weight aluminum—produced by Flynn.

MICHAEL FLYNN MANUFACTURING COMPANY

EXTRUSION DIVISION

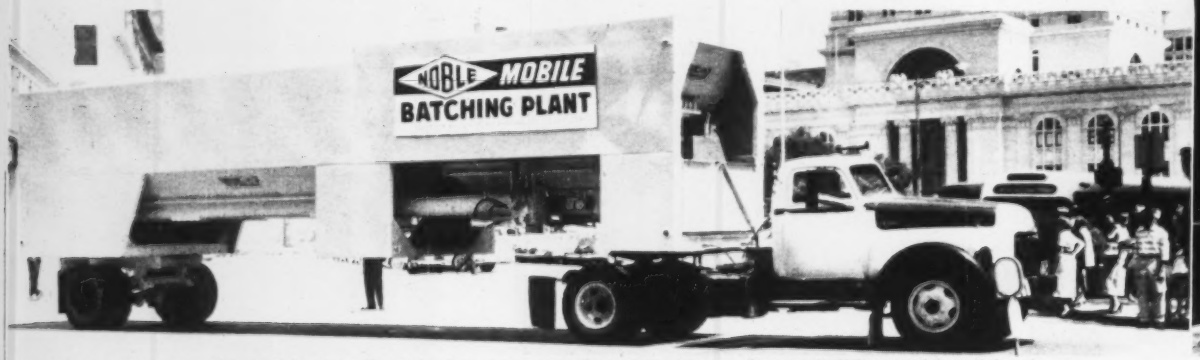
700 East Godfrey Avenue, Philadelphia 24, Penna.....Tel.: FIdelity 2-5500
51 East 42nd Street, New York 17, N.Y.....Tel.: MUrray Hill 2-0625
937 Radcliffe Road, Towson, Md. .....Tel.: VAlley 3-2090
113 Maple Street, Springfield, Mass.....Tel.: REpublic 3-2814

FLYNN
EXTRUSIONS

How job site batching with supplier $920,000 contract of 5 stationary plants

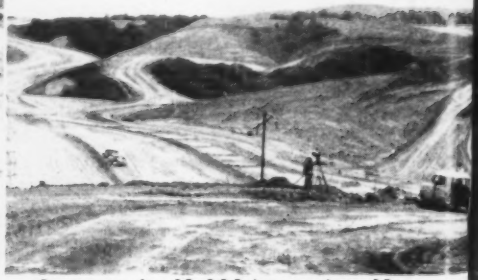
On the southern outskirts of San Francisco above San Bruno is a 5000 acre hillside area of new subdivision and shopping center construction. 6 ready-mix suppliers were in position to bid on the contracts: 5 stationary plant operators and Cupertino Concrete Co., the one Noble-Mobile batching plant on wheels operator. Cupertino was able to take the job at a price 8% below the nearest competitor yet make a profit averaging 6%. By driving his Noble-Mobile to the job site and producing there, Cupertino reduced transit truck hauls to a maximum of 2 miles and saved over 50% on hauling costs. Each Cupertino transit truck works an average of 6 hours a day making up to 12 trips of 5 yards per trip, totaling 60 yards of concrete per day per truck. 60 yards supplied from the nearest competitive stationary plant would have required 2 to 3 trucks. Cupertino saves up to 8 transit trucks.

When the job started in August, 1954, Cupertino located the Noble-Mobile in the center of the first project so the maximum haul would be only 1 mile. On completion of that project and the beginning of another project 1.5 miles distant, Cupertino closed shop on a Friday night and by the following Monday morning had dismantled, moved and reassembled the Noble-Mobile in the new location and was delivering concrete. The cost of setting up the Noble-Mobile in the new location was a mere fraction of what it would have been to install a stationary plant. Saved were the weeks and even months wasted in cutting through legal red tape to secure permits and complete construction. A further source of profit is the do-it-yourself residents of the newly completed homes.



Batching plant on wheels driven to the job site saves erection costs, taxes, site availability problems. Purchase is easier to finance than stationary plants. Pays for itself in savings from shorter hauls. Saves outlay for extra transit trucks and cost of depreciation. Many producers maintain one or more Noble-Mobiles in reserve to handle sudden surges of business and to discourage competitors from stepping in.

Pouring site on 16 per cent grade 1.9 miles below Noble-Mobile plant. Arrow points to closest stationary plant 3.4 miles distant. Noble-Mobile was stationed above construction area so all hauls would be downhill. Competitors had to compute costs on slow, ponderous up-hill drags.



Concrete for 10,000 homes in a 10 year building program! $35,000 Noble-Mobile batching plant, located 2 miles above, supplies concrete for foundations, sidewalks retaining walls, driveways, patios.

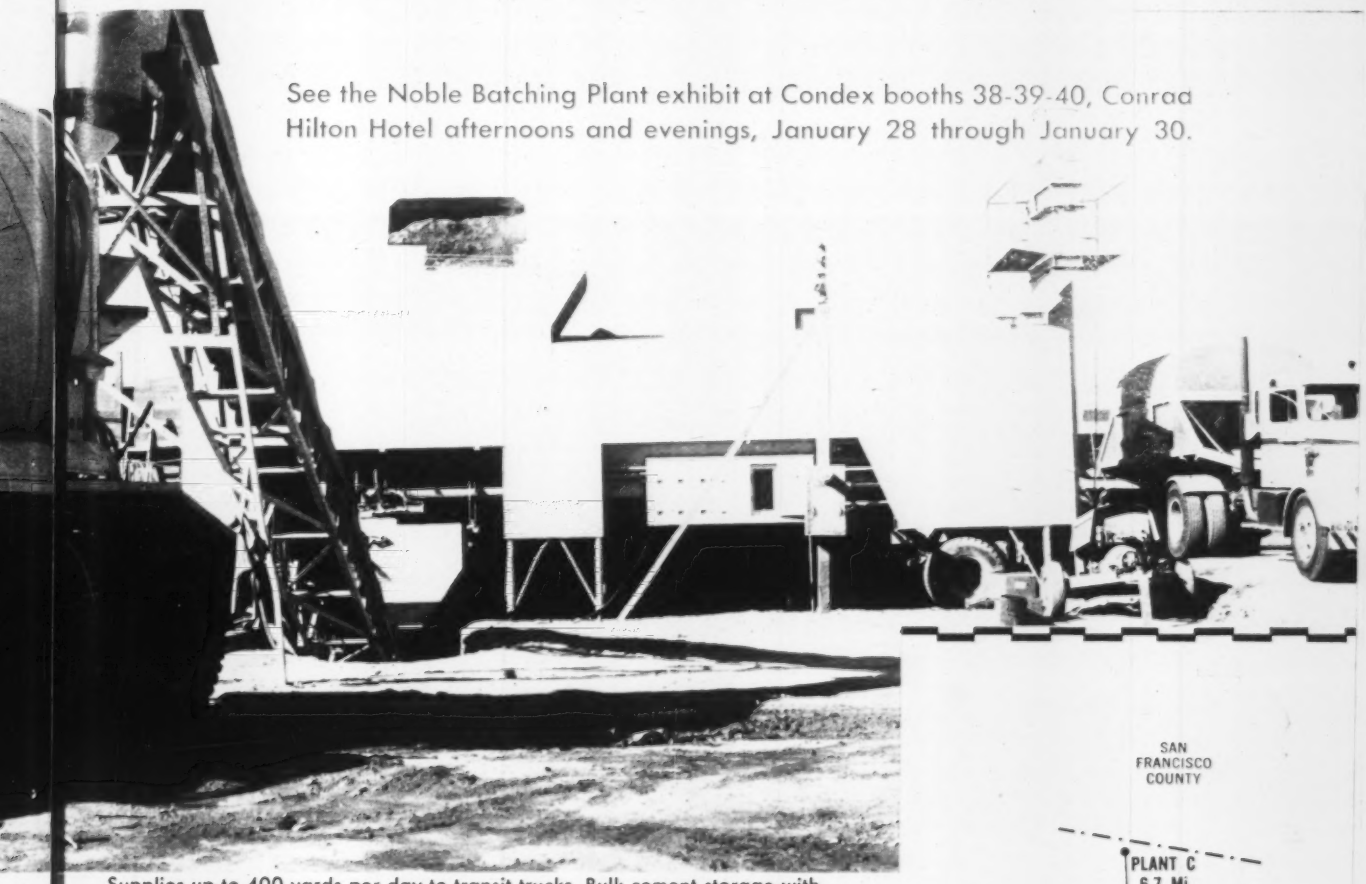
NOBLE-MOBILE
Batchmobile
Covered by patents pending

WRITE FOR CIRCULAR

THE NOBLE COMPANY • 1860-7TH ST., OAKLAND 20, CALIF. • TEMPLEBAR 2-5781
Branches: 20950 Center Ridge Road, Cleveland 16, Ohio. EDison 1-3426
518 First Ave. North, Seattle, Wash. MUtual 4878
218 Richmond St., El Segundo (Los Angeles), Calif. EAstgate 2-4518
International Sales Agent: Frazar International Corp., San Francisco

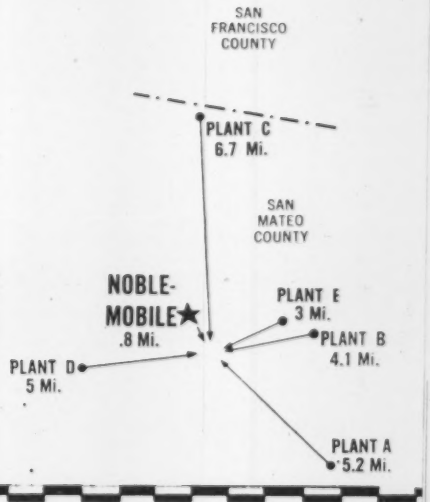
NOBLE-MOBILE got concrete at 6% profit against bids

See the Noble Batching Plant exhibit at Condex booths 38-39-40, Conrad Hilton Hotel afternoons and evenings, January 28 through January 30.



Supplies up to 400 yards per day to transit trucks. Bulk cement storage with truck hopper unloading screw and elevator. Weighs aggregates and cement separately and simultaneously. Automatic or semi-automatic control. Set up in 1 day. No field wiring, concrete foundations or crane time required on base plant.

Fed by scooploader from aggregate and sand piles. Cost to haul aggregates, sand and cement from producing site to Noble-Mobile no more than to haul to general area where competitors' stationary plants are located. Plant may also be fed by conveyor or crane.



Map of construction areas south of San Francisco showing Noble-Mobile site and competitors' stationary plants — A, B, C, D, E. Note the .8 mile haul from the Noble-Mobile compared with the up to 6.7 mile hauls from the others. "Economics of job-site batching are so sound no outside stationary plant can compete," reports Bob Soldini, Cupertino Concrete Company.

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Savings with Celluflor...

Edward Martin
BAYSHORE CONSTRUCTION CO.

Milcor

CELLUFLOR

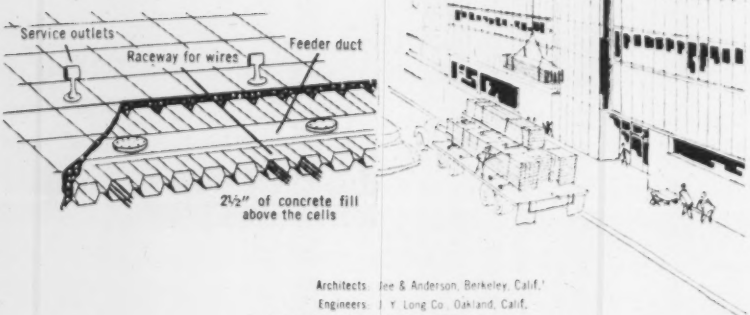
saved 6-months on this job!

Edward Martin, partner in Bayshore Construction Co., Oakland, Calif., is sold on Celluflor. Here's what he writes:

"The use of Milcor Celluflor permitted all trades to work simultaneously, instead of one trade following another. We saved over six months on the job schedule for the El Dorado Building in downtown Oakland and permitted occupancy of 40,000 sq. feet of office space for our major tenant, The Pacific Telephone Co., six months after ground breaking."

Construction time savings are *dollar* savings — in overhead, financing and insurance. Earlier occupancy means *faster investment returns.* But the *greatest saving* from Celluflor accumulates over the years because of the electrical flexibility it provides. Service outlets can be installed anywhere on the floor without expensive alterations.

Write for Catalog 270, or refer to Sweet's — Section 2a/In.



Architects: Lee & Anderson, Berkeley, Calif.
Engineers: J. Y. Long Co., Oakland, Calif.
General Contractors: Bayshore Construction Co., Oakland, Calif.

INLAND STEEL PRODUCTS COMPANY
Dept. M, 4147 W. Burnham Street • Milwaukee 1, Wisconsin
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KANSAS CITY • LOS ANGELES • MILWAUKEE • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS

. . . Reader Comment

matter much—in this latest experiment with humans and their lives—what I say.

1. Fluoridation has not been proven safe.

2. It is a senseless squandering of the taxpayers' money.

3. Cheaper methods are available and not so dangerous.

4. It has not been proven that sodium fluoride will prevent decay of human teeth.

5. No insurance company will cover the operator. (This can be verified in the printed reports of the Congressional record on fluoridation.)

6. It is against the fourth amendment of the constitution of the U. S.

7. Many doctors do not realize just what sodium fluoride can do to the calcium of the body.

8. Mechanical failure can cause the death of thousands.

9. I could go on and on but it will do no good for people just won't stop and think and our good doctors are too busy with helping the sick and those who do read do not read about subjects like this.

10. There is a medical paper by W. J. McCormick, M.D., of Toronto, Canada (accepted for publication in Archives of Pediatrics, New York, 1953), entitled "Domestic Water Fluoridation—Its Pathogenic Potentialities." On the strength of this paper I fear fluoridation.

FERDINAND BACHL
Detroit, Mich.

Editor's Note: A paper rebutting Dr. McCormick's appeared later this year in the same medical journal. We don't share Reader Bachl's fear.

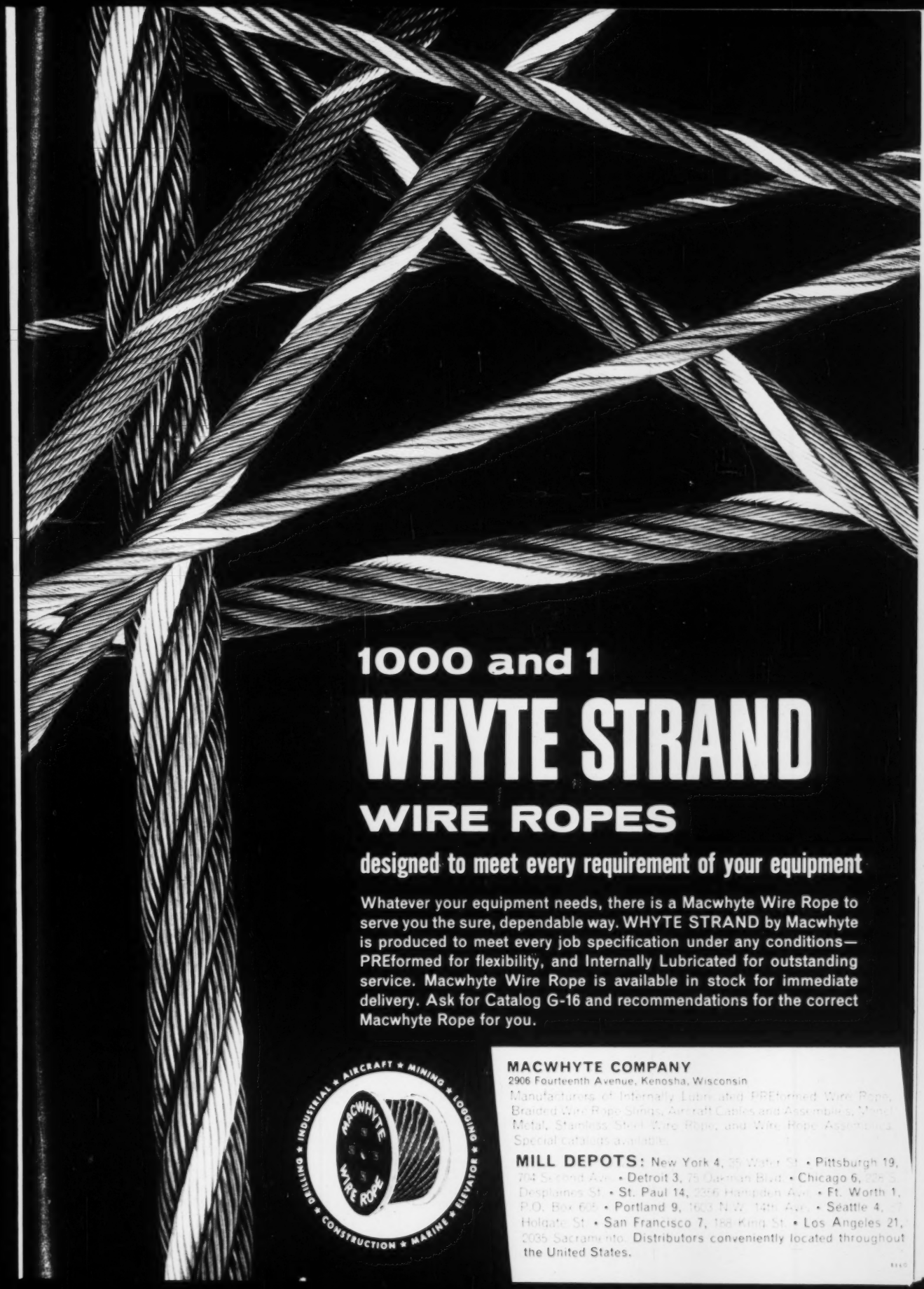
Another Fluoridation Foe

SIR—Your extraordinary editorial appears out of place in an engineering magazine.

So far as I have been able to discover, no one questions the fact that fluoride is a cumulative poison. . . . All agricultural literature is unanimous in condemning fluorides for animals and seems to indicate that the resistance of animals to fluorides is much higher than humans'.

According to the A.M.A. Journal, the Councils of Food and Nutrition and Chemistry and Pharmacy reported to the House of Delegates that they knew of no deleterious effects from the use of fluoride in the recommended amount (approximately 1 ppm), following which the House of Delegates endorsed the principle of fluoridation of public water supplies. (Emphasis added.)

(*Reader Comment continued on p. 24*)



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designed to meet every requirement of your equipment

Whatever your equipment needs, there is a Macwhyte Wire Rope to serve you the sure, dependable way. WHYTE STRAND by Macwhyte is produced to meet every job specification under any conditions—PREformed for flexibility, and Internally Lubricated for outstanding service. Macwhyte Wire Rope is available in stock for immediate delivery. Ask for Catalog G-16 and recommendations for the correct Macwhyte Rope for you.

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THE LAKE PONTCHARTRAIN CAUSEWAY

New Orleans, Louisiana

This imposing structure rests on 4,386 fifty-four inch Raymond Cylinder Piles averaging 83 ft. in length. Completed in August, 1956.

William Watson Bridge, Lake Pontchartrain, La. is supported by 2,795 Raymond Precast Piles. Completed in 1927.

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RAYMOND CYLINDER PILES

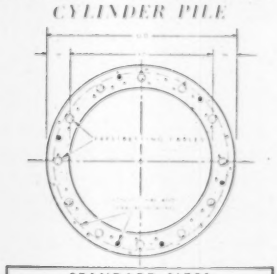
WHY RAYMOND PRESTRESSED CONCRETE CYLINDER PILES ARE SUPERIOR UNDER CERTAIN CONDITIONS

Raymond Cylinder Piles—the latest development in our 60 years' foundation experience—assures greater structural strength, increased load capacity and longer life. These piles are manufactured in a series of sections placed end-to-end, which are joined by post-tensioned cables of high tensile steel wire and grouted to form a homogeneous, impervious support of extraordinary strength. Since Raymond Cylinder Piles are usually driven open end, there is a large area of contact with the soil, which provides greater resistance, thereby enabling higher load capacities. In addition, prestressed concrete insures longer life with extremely low maintenance because it is fireproof and not subject to corrosion or damage by marine life and water.

HOW RAYMOND CYLINDER PILES CAN HELP LOWER CONSTRUCTION COSTS

On large projects, Raymond Cylinder Piles have been a major factor in saving time and money. For example, the new 24 mile Lake Pontchartrain Causeway (shown in the large picture at the left) cost under $8 per square foot to construct. While labor costs have increased 70% and material costs 100%, the cost increase of this bridge has risen only 50% when compared to the cost of the William Watson Bridge, built in 1927 by conventional methods. Utilizing assembly line manufacturing methods and improved installation procedures, the Lake Pontchartrain Causeway—the longest highway bridge in the world—was completed four months ahead of schedule.

CROSS SECTION—RAYMOND PRESTRESSED CONCRETE CYLINDER PILE



STANDARD SIZES			
OD	ID	W	NUMBER OF PRESTRESSING CABLES
36	29	4	8-10-12-14 or 16
54	46	4	8-10-12-14 or 16

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AROUND THE WORLD FOUNDED 1901

COMPLETE CONSTRUCTION SERVICES ABROAD

OUR 60th YEAR

RAYMOND CONCRETE PILE CO.

140 Cedar Street, New York 6, N. Y.

Branch Offices in Principal Cities of the United States, Canada, Central & South America

You are cordially invited to send for our new Highway Brochure, which gives a detailed resume of how Raymond can help you and the National Highway Program. Just write Department E-1, Raymond Concrete Pile Company, 140 Cedar St., New York.

FOR ROAD WORK

Tamping fill around 4 ft. concrete pipe culvert on New York State Thruway Extension near West Seneca, N. Y. The Barco Rammers are owned by S. J. Groves & Sons Co., Syracuse, N. Y. (Photo: CONSTRUCTIONEER)

Barco Rammers are Essential!

CHECK THE RECORDS for *soil compaction* on every top ranking highway, toll road, thruway, or freeway built in recent years and you will find Barco Rammers! Here are the reasons:

The key to better construction—

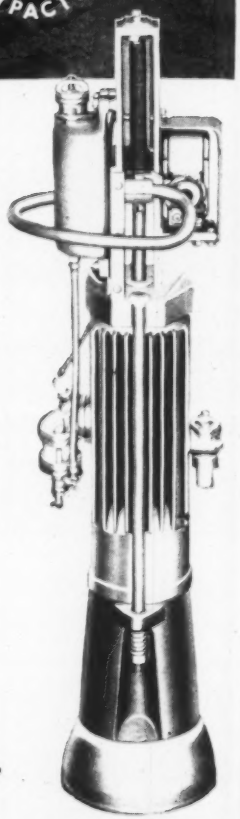
No modern trend in construction has had a more phenomenal growth than the specification of HIGH DEGREE SOIL COMPACTION for all kinds of projects for longer life and better value.

Easily meet rigid specifications—

In test after test, Barco Rammers have demonstrated their ability to deliver 95% to 97.5% compaction (modified Proctor Method)—EASILY! EFFICIENTLY! ECONOMICALLY! The Barco Rammer is especially useful for compacting fill in restricted areas. ONLY the Barco Rammer can produce specified high degree compaction on lifts up to 20 inches.

Get jobs finished on time—

One of the biggest advantages offered by Barco Rammers is ability to handle work in minimum time. On area tamping, one man can average 20 to 30 cubic yards of fill per hour. On trench backfill, using lifts up to 24", the rate for 18" trench is 360 to 600 feet per hour. Ask for a demonstration.



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for High Degree Soil Compaction

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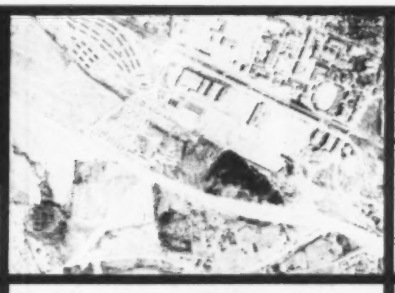
HOW TO ADVANCE HIGHWAY STARTING DATES UNDER THE FEDERAL PROGRAM IN YOUR STATE

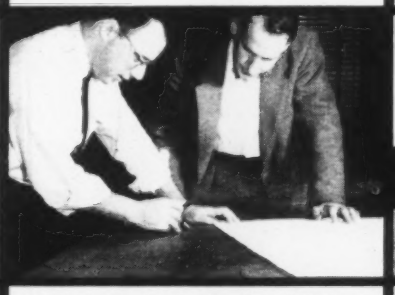
CONSTRUCTION STARTING DATES for highways like this are advanced by AERO mapping methods.



RECONNAISSANCE PHOTOS from speeding AERO planes permit alternate route selections, minimizing costly field trips.

AERO TOPOGRAPHIC MAPS at 5 ft. contour interval are used for preliminary location and design.

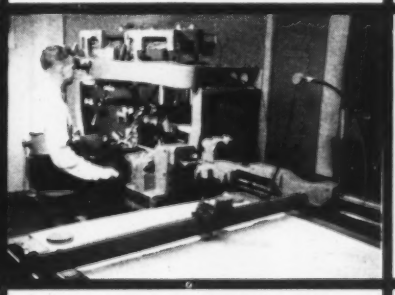
1-FT. CONTOUR INTERVAL MAPS, compiled by precision AERO methods, are used for final location and design.



CONSERVE VALUABLE ENGINEERING MANPOWER. AERO handles the mapping job—leaves your own busy staff free for other work.

GROUND CONTROL DATA for AERO topographic maps are obtained by our trained field surveymen, using precision theodolites.

AERO HAS THE PLANES AND PILOTS. Our fleet of 35 aircraft is flown by men who've been with us an average of 12 years.



TRAINED, EXPERIENCED MAPPERS operate sensitive, accurate stereoplotting equipment, rush needed maps on around-the-clock schedule.

MAJOR HIGHWAY PROJECTS IN 23 STATES now are being mapped by AERO. It pays to call on AERO—the pioneer and leader.

Save time, money and manpower—let AERO do the mapping for the federal highway program in your state!

AERO SERVICE CORPORATION

PHILADELPHIA 20, PENNSYLVANIA

Oldest Flying Corporation in the World

PRECISE AERIAL MOSAICS • TOPOGRAPHIC MAPS • PLANIMETRIC MAPS • RELIEF MODELS • AIRBORNE MAGNETOMETER SURVEYS

2 Safety-Designed GUARD RAILS

USF BARRIER-BEAM

Note these famous USF design features: (1) deep corrugations for high impact resistance, (2) broad surface area for maximum visibility, (3) exclusive rounded Safety Top edge, (4) convenient off-post splicing for faster erection. Use economically for highways, parking lots, parks, race tracks, bridges and approaches.

USF UNIVERSAL-BEAM

A new, specially-designed beam-type rail that lays either end to traffic and solves stock problems because it is completely *interchangeable* with similar parts of other manufacturers. 9-bolt connection with oval neck bolts assures maximum joint strength.

Both Barrier-Beam and Universal-Beam are available in either 10 or 12 gauge.

Write for more complete information.

UNITED STEEL FABRICATORS, INC.
WOOSTER, OHIO

PRODUCTS
Hollow Metal Doors • Prefabricated Metal Buildings • Window Wells • Highway Guard Rail • Bridge Flooring • Steel Forms for Concrete Bridge Floors • Corrugated Metal Pipe • Sectional Plate Pipe and Pipe Arches

. . . Reader Comment

"Texas" or "Colorado" teeth are notorious . . . unattractive from the yellow to brown mottling . . . frequently have to be replaced by false teeth . . . and they occur in localities having only 1 ppm of natural fluoride.

Engineers have one great advantage over doctors—we deal with inanimate matter. . . . Medicine is still much more of an art than a science. . . . Doctors bury their failures. . . . Fluoridation of public water supplies is medication for the control of a non-contagious disease . . . a violation of the most fundamental moral and legal right of man. . . . An editorial commending Newark for instituting the use of tablets for those who want them would have been more fitting.

It is the compulsion inherent in fluoridation of public water supplies that causes all the controversy. . . . Are we to remake the U. S. over to the pattern of Hitler Germany or Stalin Russia? . . . What will be next? . . . The Daily Worker enthusiastically supports fluoridation. . . . Communists in Germany attack it as an example of "American imperialism".

Let ENGINEERING NEWS-RECORD stick to its knitting—which is engineering and not unproven controversial medico-social subjects.

WILLIAM CHAUVENET
Consulting Engineer
Santa Fe, N. M.

Editor's Note: Reader Chauvenet's enthusiastic opposition to fluoridation on "medico-social" grounds belies his contention that we engineers should stick to our engineering.

CALENDAR

National Association of Home Builders, annual convention and exposition, Hotel Sherman, Hotel Conrad Hilton and Coliseum, Chicago, Ill., Jan. 20-24.

Associated Equipment Distributors, 38th annual meeting, Conrad Hilton Hotel, Chicago, Jan. 27-30.

American Road Builders Association, annual meeting and road show, Chicago Amphitheater, Jan. 28-Feb. 2.

Reinforced Plastics Div., Society of the Plastics Industry, Inc., 12th Annual Technical and Management Conference, Edgewater Beach Hotel, Chicago, Ill., Feb. 5-7.

Eastern Snow Conference, 14th annual meeting, Onondaga Hotel, Syracuse, N. Y., Feb. 7-8.

American Concrete Institute, 53rd annual convention, Statler-Hilton Hotel, Dallas, Tex., Feb. 25-28.

Sherman Power Digger Digs Six to Eight 60 Foot Trenches, 7 Feet Deep, in a Single Day!

Five Sherman Power Diggers, averaging 40 hours of work each, every week, are doing more than their share to maintain the position of Bell Plumbing and Heating Co., Denver, as one of the nation's major contractors.

As Mr. William Stecher, plumbing superintendent for Bell, puts it, "We have found that this equipment can dig six to eight sixty-foot ditches a day. All of them are seven feet deep. I would guess that each machine does the work of six men at about one half the price."

In addition to digging trenches for water and sewer lines, the Shermans are used for a variety of other digging and trenching jobs about the building sites.

With their Shermans on the job, Bell Plumbing and Heating no longer has to sub-contract normal digging jobs. Before purchasing the units, schedules often had to be adjusted for the sub-contractor and delays of several days were not uncommon. Now, work is completed on schedule.

Sherman Power Diggers can cut costs and speed production for your company, too. See your local Ford Tractor dealer TODAY for a demonstration or write for free Bulletin No. 1450.

See the Sherman Power Digger soon at your local **FORD TRACTOR DEALER**

Sherman

PRODUCTS, INC.

ROYAL OAK, MICHIGAN

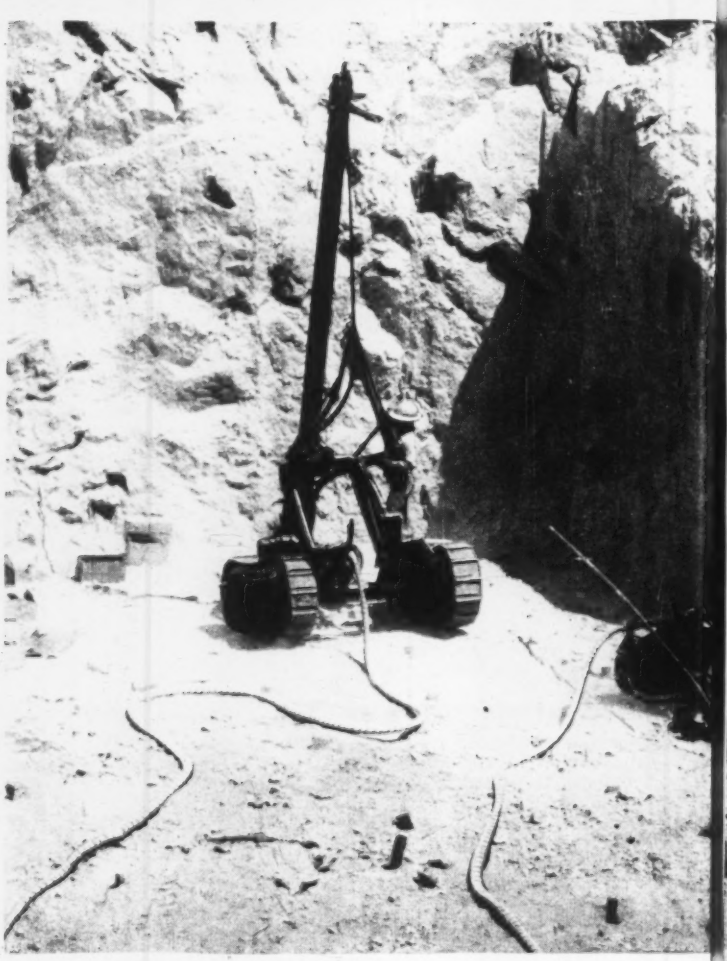
POWER DIGGERS* • FRONT END LOADERS • FORK LIFTS

Sherman SP Products®

*Designed, Engineered and Manufactured jointly by Sherman Products, Inc., Royal Oak, Michigan, Wain-Roy Corporation, Hubbardston, Mass.

© 1956 Sherman Products Inc

Mounted on crawler tracks for maximum maneuverability, the G-800 Tracdril gives you the speed of a heavy drifter, the constant feed of a CP Drill Carriage, and the rapid positioning of its hydraulically actuated U-arm.



Practically a one-man tamping gang, this CP Super Triplex Backfill Tamper is a "three-legged stomper" that really packs dirt.

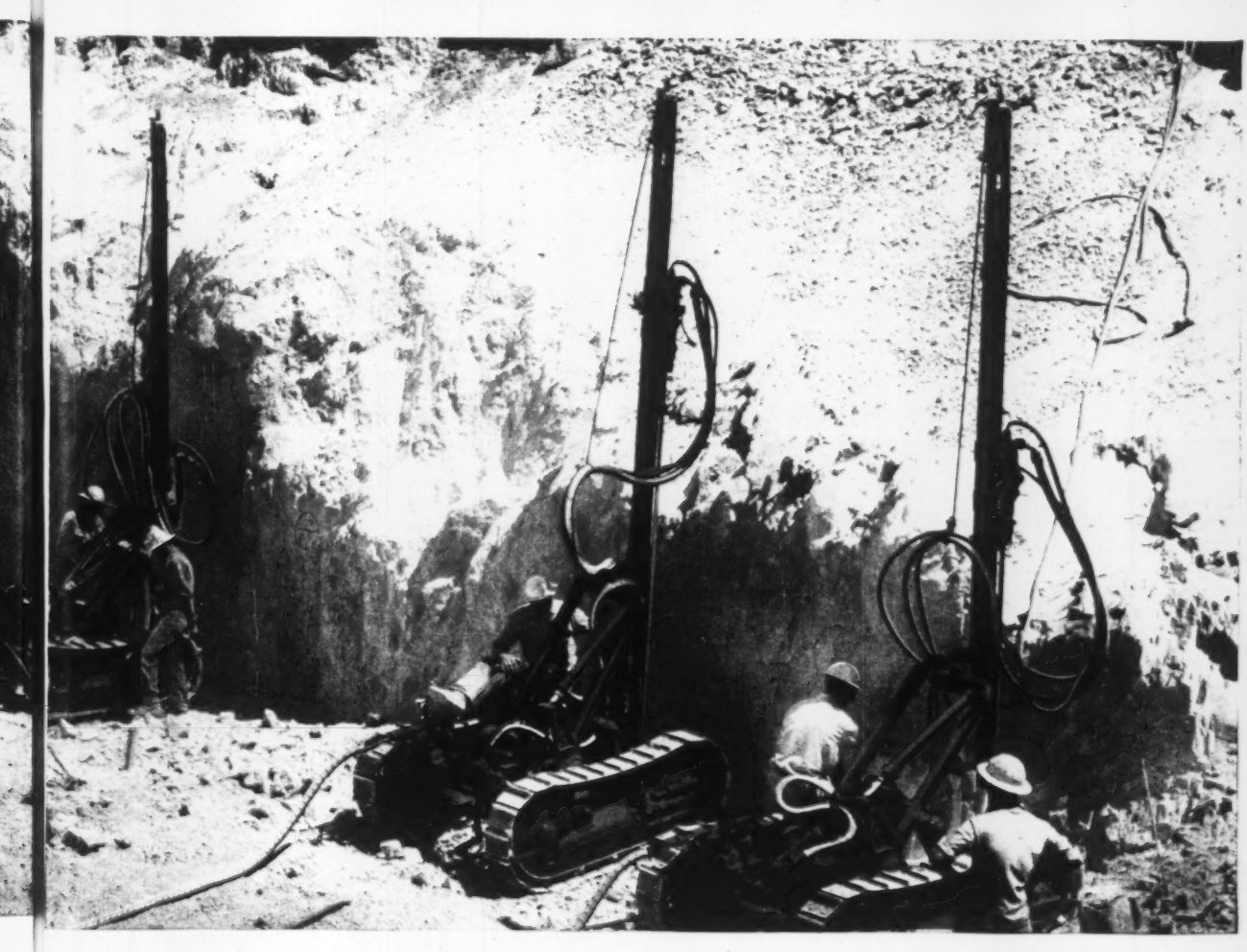
Keeps ahead

CP construction equipment takes rough treatment in stride . . . keeps work moving at a clip that meets tight schedules. That's why contractors everywhere specify Chicago Pneumatic for the "big jobs".

Chicago Pneumatic, first to offer a Rotary Compressor in a capacity to meet every job requirement from 900 to 125 cfm., manufactures a complete line of equipment and accessories for the construction industry. For information call your equipment dealer or write direct to *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



CP CONSTRUCTION EQUIPMENT

Whether you require a single unit or a whole battery of portables, you can't beat CP "Power Vane" Rotaries for tops in dependable operating performance under the toughest conditions. Capacities: 125, 210, 365, 600 and 900 cfm.

Royal Cord Air Hose

WEAKLINGS DON'T LAST HERE...

It takes U. S. Royal Cord (the air hose built like a tire) to handle jobs like this—to take the worst kind of punishment *wherever* air lines are used. The cord construction increases resistance to internal pressure, yet produces a hose of extreme flexibility. U. S. Royal Cord has remarkable resistance to blows or bruises caused by blasting, or by heavy tools falling on the hose or by trucks and other vehicles running over it. *Never needs cribbing.* Its smooth, brown cover is the *toughest* ever put on a molded hose. No matter how great the shock, no matter how excessive the pressures on any job, U. S. Royal Cord is the *quality* air hose that pays off—in jobs performed and in long life. It proves that it never pays to buy cheaply-constructed hose.

U. S. Royal Cord Air Hose is obtainable at any of the 28 "U. S." District Sales Offices, at selected "U. S." distributors, or by writing U. S. Rubber, Mechanical Goods Division, Rockefeller Center, New York 20, N. Y.

Mechanical Goods Division

United States Rubber

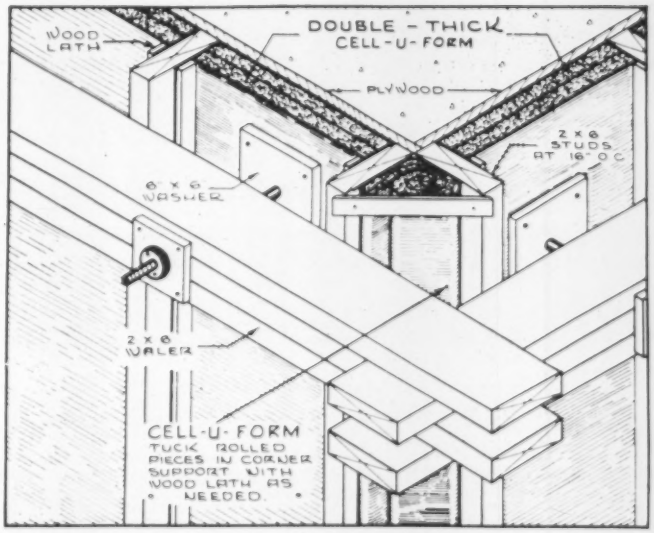
Available FAST from U. S. Steel Supply

to lower your winter construction costs

USS DI-LOK
CONCRETE REINFORCING BARS

The deep, closely spaced ribs of USS DI-LOK Reinforcing Bars give tighter grip per foot and check formation of wide tensile cracks. We can quickly deliver all standard sizes . . . cut to length or bent as required. Good detailed placing plans are furnished as required. Our engineers will visit your job regularly and schedule shipments as work progresses.

CELL-U-FORM
COLD WEATHER
CONCRETE FORM INSULATION


WOOD LATH
DOUBLE - THICK CELL-U-FORM
PLYWOOD
2 x 6 STUDS AT 16" O.C.
6 x 6 WASHER
2 x 6 WALER
CELL-U-FORM TUCK ROLLED PIECES IN CORNER SUPPORT WITH WOOD LATH AS NEEDED.

To further help our customers reduce the costs of winter construction and to assure the correct curing of concrete work during cold weather, we can give you immediate delivery of CELL-U-FORM—the new blanket insulation. CELL-U-FORM insulation eliminates the need for tarpaulin enclosures, fuel and watchmen. Engineers estimate that the costs of using CELL-U-FORM are about ½ that of heated enclosures. CELL-U-FORM withstands rough handling and exposure to weather.

ORDER NOW! With USS DI-LOK Reinforcing Bars and CELL-U-FORM insulation, you can safely work with concrete right on through the coldest weather. Don't let winter tie up a job. Use these proven products and keep pouring! Ask for quotations.

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General Offices: 208 So. La Salle St., Chicago 4, Ill. Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL

THESE '57 CHEVIES TURNED THE TOUGH ALCAN HIGHWAY INTO A TURNPIKE!

They took the "teeth" out of North America's toughest truck run in an amazing display of stamina and dependability! The Chevrolet Alcan test called for great truck components . . . and here they are, the same modern features you'll get in *your* '57 Chevy!

Modern high-compression 6's—a time-proved Chevrolet truck Thriftmaster 6 made the tortuous Alcan Highway test look easy . . . registered a high 18.17 miles per gallon!

Short-stroke V8 power—with the shortest stroke of any truck V8's, new Chevy engines stand first in their field for efficient load-pulling! Their great performance in Alaska proved it.

Safe, sure brakes now Alcan proved—in light- and medium-duty models, Hydrovac power brakes* supplied up to 85% of the braking effort!

Unit-design cab and body construction—Chevrolet truck cabs and bodies remained tight and solid on Alcan bumps, showed that they're built to *last!*

Rugged Synchro-Mesh manual transmissions—they displayed never-say-die durability . . . came through with smooth, flexible, trouble-free performance!

*Easy-going Hydra-Matic transmission**—it reduced driver's work immeasurably and it saved wear on drive-line parts, too!

Sturdy frames and long-leaf springs—these brawny chassis components proved they can take it when the going is roughest . . . took the Alcan's worst with strength to spare!

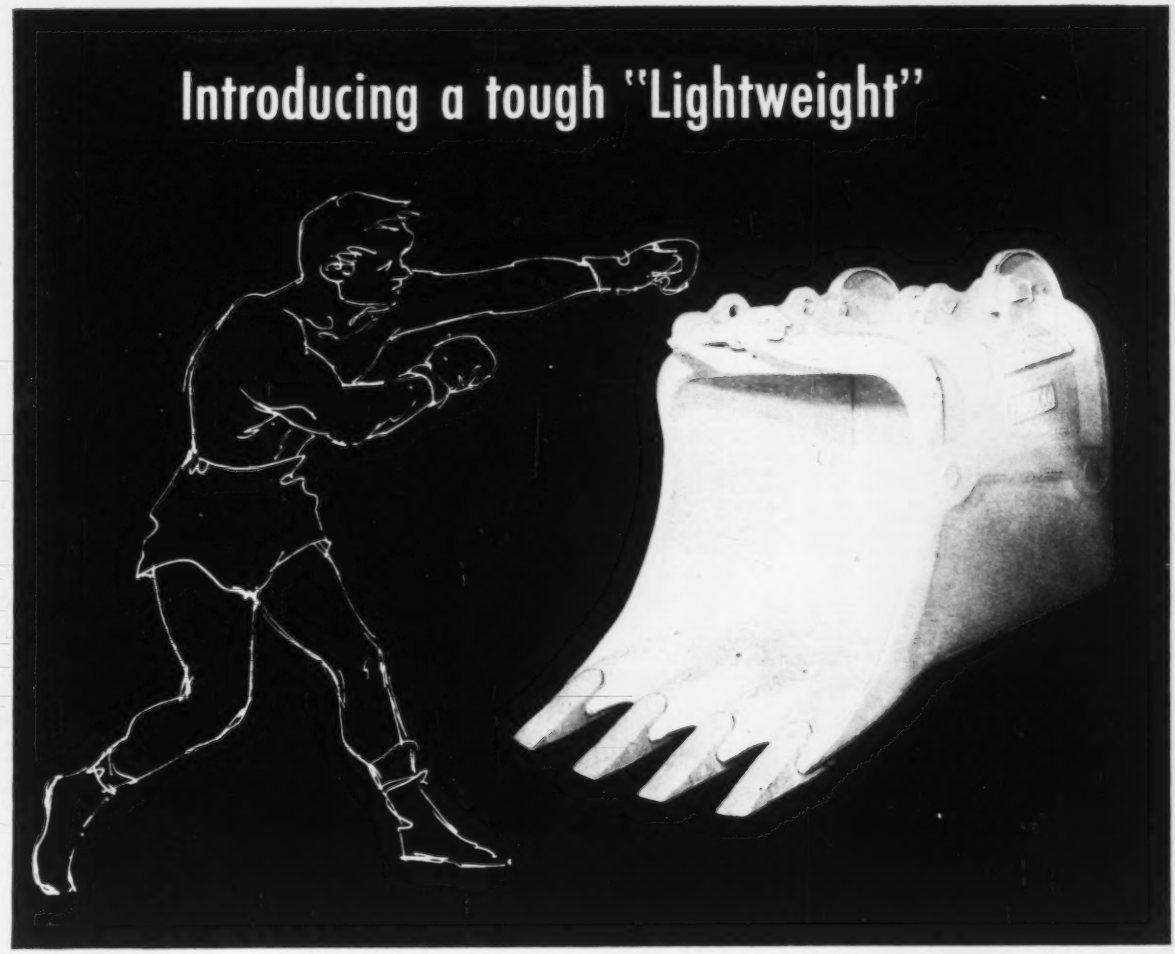
These Alcan-proved Task-Force 57 features and others like them (such as extra-heavy rear axles, easy-rolling Ball-Gear steering, and new, improved tubeless tires) are ready to tame your tough truck runs too! Boost your hauling profits by seeing your Chevrolet dealer soon! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

1957 CHEVROLET TASK-FORCE TRUCKS

PROVED ON THE ALCAN HIGHWAY . . . CHAMPS OF EVERY WEIGHT CLASS! CHEVROLET

Introducing a tough "Lightweight"



NEW Amsco® Manganese Steel LIGHTWEIGHT DIPPER

Rugged 3/4 yd. dipper, made of the "toughest steel known," actually work-hardens under impact

Those big, tough Amsco Dippers now have a smaller brother. With this new, rugged, lightweight dipper, small shovel operators can enjoy the combined advantages of long-wearing manganese steel and proved Amsco design features, such as:

- One-piece manganese steel back castings
- Arch formed by complete box section for maximum strength
- Teeth are set for clean, fast digging
- Interior is designed for rapid dumping
- Lugs for handle, back, and braces are cast integral with back—for extra strength
- 25% lighter than standard Amsco 3/4 yd. dipper, permitting use on light-duty shovels and allowing their developed power to be more fully utilized
- Curved door in back, for full-capacity loading with each pass

Ask your shovel manufacturer for full information—or write us direct for descriptive literature.

"Vital Statistics" on this new lightweight champ

Height of front over teeth	4 ft. 3/8 in.
Height of back	2 ft. 7 in.
Opening at top	2 ft. 5 in.
Opening at bottom	2 ft. 7 in.
Approximate weight	1550 lbs.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DELAWARE, OAKLAND, ST. LOUIS, JOLIETTE, QUEBEC

THIS IS THE FIRST PROJECT IN THE UNITED STATES

ON WHICH PAVING CONTRACT WAS AWARDED UNDER THE PROVISIONS OF THE NEW

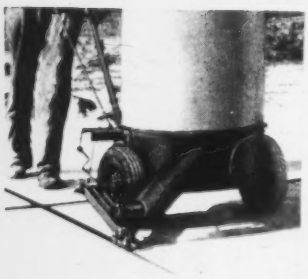
FEDERAL HIGHWAY ACT OF 1956

MISSOURI STATE HIGHWAY COMMISSION

THE KOSS CONSTRUCTION COMPANY, DES MOINES, IOWA

CONTRACTOR

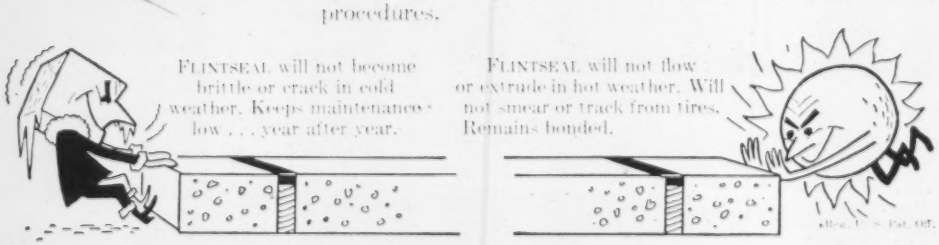
...and will use 47,000 pounds of FLINTSEAL



FLINTSEAL*. . . hot-poured rubber asphalt joint sealing compound for concrete pavements . . . gives lasting protection from leakage and *positive* sealing . . . during expansion and contraction cycles of pavement slabs. Meets Fed. Spec. SS-S-164.

Project I-89(7)&I-139(14) Laclede County, Mo., Awarded Aug. 2, 1956. FLINTSEAL supplied by Carter-Waters Corp., Kansas City, Mo.

Write for complete technical data and specification procedures.


FLINTSEAL will not become brittle or crack in cold weather. Keeps maintenance* low . . . year after year.
FLINTSEAL will not flow or extrude in hot weather. Will not smear or track from tires. Remains bonded.

*Reg. U. S. Pat. Off.

FLINTKOTE

THE FLINTKOTE COMPANY, Industrial Products Division, 30 Rockefeller Plaza, New York 20, N. Y.

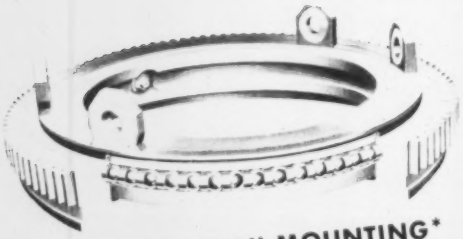
take a GOOD LOOK at the NEW LOOK in THEW LORAIN®

Take a good, long look and see everything that's new and different in the 1957 Lorains. Modern cab designs, new models, different type crane booms, increased capacities, easier power controls, "Shear-Ball" mountings and torque converters . . . these are some of the more important features. There are many, many more—for more economical operation, increased output, greater operator comfort and ease of operation and greater efficiency in every way! These pages will give you an idea of what Lorain has to offer in 1957. TAKE A GOOD LOOK AT THE NEW LOOK IN THEW LORAIN.

take a look at the new 2½-yd. LORAIN-85A

The new 2½-yd. Lorain-85A is the most different looking of the new Lorains because it wears the new cab design that is new in appearance, new in operator comfort, convenience and protection—and the rest of the "85A" matches the advanced cab design. Take a look at these features: 2-lever, "Joy-Stick", metered-air controls for all friction clutches—air control of all crawler operations—"Shear-Ball" mounting that eliminates center pin and rollers of all kinds—choice of 2 crawlers—torque converter power-take-off—new square-tubular-chord boom permitting lengths of 200 ft. plus tip—40, 50, 60-ton cranes.

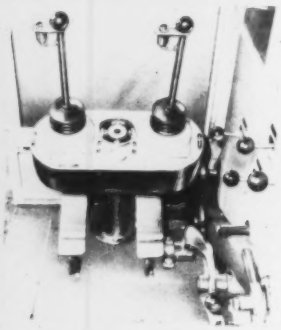
Take a GOOD LOOK at these 3 exclusive LORAIN FEATURES



"SHEAR-BALL" MOUNTING*

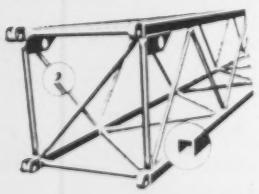
This exclusive patent-applied-for feature is standard or available on most Lorains. It truly gives "ball bearing," rock-steady swing and completely eliminates center pin and nut, centering gudgeon, hook or top rollers and exposed roller path with their attendant wear, need of adjustment and maintenance. There is nothing else like it.

2-LEVER "JOY STICK" POWER CONTROLS



This type of "Joy Stick" controls power-actuates all turntable friction clutches for easier, faster, simpler operation. Uses only 2 levers instead of the usual 3 or 4. Reduces operator motion, effort and fatigue. Increases production. Now available on all classes of Lorains. No other type of controls is so effortless to use.

SQUARE-TUBULAR-CHORD BOOM*



This new Lorain patent-applied-for boom design has startling advantages over conventional types. The main chords are of square tubing—the lacings of continuous round tubing welded at common points to the chords to create a "banding" effect. The result is a lighter, stronger, boom for increased lifting capacities and greater reaches with clamshell and dragline buckets. Available on all classes of Lorains.

CRAWLERS

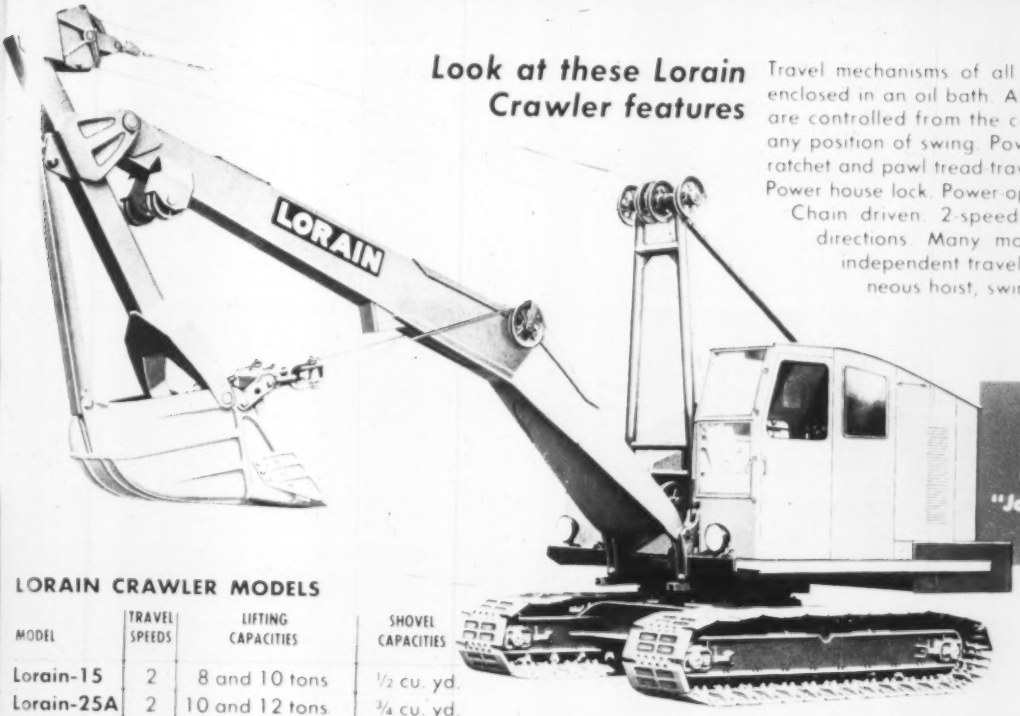
Crawler-mounted Lorains are built to conquer the worst possible terrain and travel conditions. Many models offer a choice of crawler lengths and widths, as well as tread widths to match job needs. Maneuverability, ruggedness, good soft-ground flotation and resistance to "nosing-in" are additional features of Lorain crawlers.

MOTO-CRANES

Lorain Moto-Cranes provide unlimited rubber-tire, high speed mobility (up to 45 mph) to move between and around the jobs fast. "Moto-Crane" carriers are Lorain-designed-and-built to do a job no commercial motor truck chassis can do under the stresses and strains of shovel-crane operation. Today's Moto-Crane is the result of 39 years of experience in building rubber-tire cranes . . . more than any other manufacturer.

Look at these Lorain Crawler features

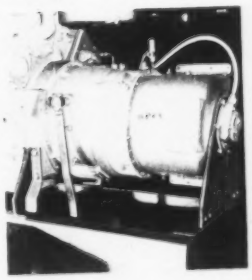
Travel mechanisms of all Lorain crawlers are enclosed in an oil bath. All crawler operations are controlled from the cab with turntable in any position of swing. Power-operated, 4-way ratchet and pawl tread-travel lock. Power steer. Power house lock. Power-operated jaw clutches. Chain driven. 2-speeds available in both directions. Many models available with independent travel, permitting simultaneous hoist, swing and travel.



See the New LORAIN-26 with "Joy Stick" Controls Booth No. 503

LORAIN CRAWLER MODELS

MODEL	TRAVEL SPEEDS	LIFTING CAPACITIES	SHOVEL CAPACITIES
Lorain-15	2	8 and 10 tons	½ cu. yd.
Lorain-25A	2	10 and 12 tons	¾ cu. yd.
Lorain-26	2	15 and 17½ tons	¾ cu. yd.
Lorain-50	1	20 tons	1 cu. yd.
Lorain-56	1	25 and 30 tons	1¼ cu. yd.
Lorain-72	2	30 tons	1½ cu. yd.
Lorain-85A	2	40 to 60 tons	2½ cu. yd.



TORQUE CONVERTER

Torque converter power-take-offs are available on all classes of Lorains. This is the most efficient, smoothest method of taking full advantage of the abundant power supplied for turntable operations. Lots of lugging and "never-say-die" power that adjusts automatically to digging needs; no machinery shock; no engine stall.

LORAIN MOTO-CRANE MODELS

MODEL	CARRIERS	LIFTING CAPACITIES	SHOVEL CAPACITIES
MC-107	6x4	7 & 8 tons	⅜ cu. yd.
MC-110	6x4	10 tons	½ cu. yd.
MC-254	6x4, 6x6	15 tons	¾ cu. yd.
MC-254W	6x4, 6x6	17½ tons	¾ cu. yd.
MC-424&W	6x4, 8x4	22½ tons	¾ cu. yd.
MC-425&W	6x4, 8x4	25 tons	1 cu. yd.
MC-530	6x4, 6x6, 8x4	30 tons	1 cu. yd.
MC-530W	6x4, 6x6, 8x4	35 tons	1¼ cu. yd.
MC-875	6x4	75 tons	

See the New LORAIN MC-530W on 4-axle Carrier Booth No. 503

ook at these Lorain Moto-Crane features

4, 6x6, and 8x4 carriers available. Power steer. wer brakes. Big multiple tires . . . rear axles on rocker ams and ample tractive effort for off-the-road travel. ual-remote" control available on many models (pro- es one-man operation from turntable cab of both ntable and carrier operations). Crane booms up to 0 ft. Pin-connected booms. 2-piece, extensible tips.

LOOK WHAT'S NEW IN

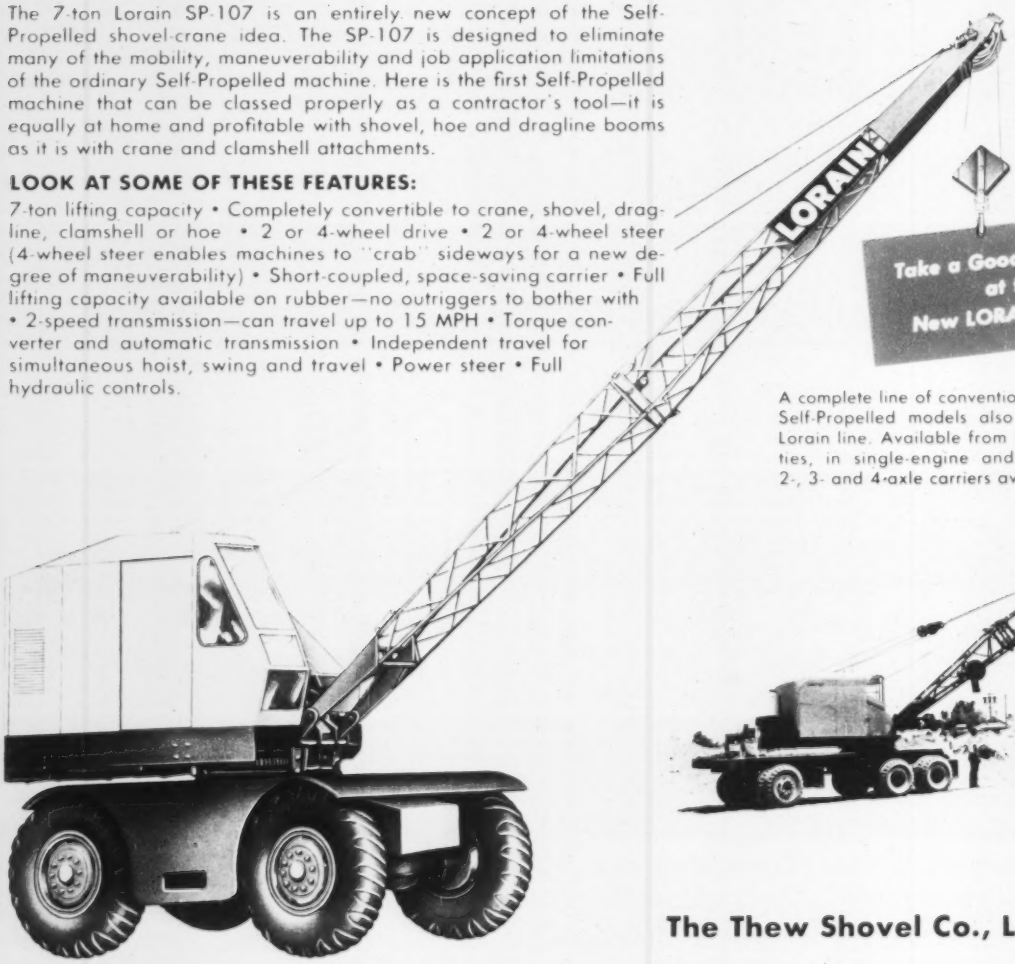
SELF-PROPELLED CRANES

THE NEW LORAIN SP-107

The 7-ton Lorain SP-107 is an entirely new concept of the Self-Propelled shovel-crane idea. The SP-107 is designed to eliminate many of the mobility, maneuverability and job application limitations of the ordinary Self-Propelled machine. Here is the first Self-Propelled machine that can be classed properly as a contractor's tool—it is equally at home and profitable with shovel, hoe and dragline booms as it is with crane and clamshell attachments.

LOOK AT SOME OF THESE FEATURES:

7-ton lifting capacity • Completely convertible to crane, shovel, dragline, clamshell or hoe • 2 or 4-wheel drive • 2 or 4-wheel steer (4-wheel steer enables machines to "crab" sideways for a new degree of maneuverability) • Short-coupled, space-saving carrier • Full lifting capacity available on rubber—no outriggers to bother with • 2-speed transmission—can travel up to 15 MPH • Torque converter and automatic transmission • Independent travel for simultaneous hoist, swing and travel • Power steer • Full hydraulic controls.

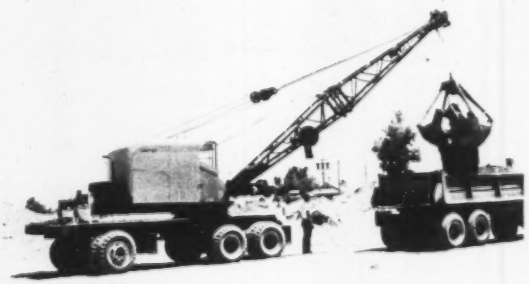


Take a Good Long Look at the New LORAIN SP-107

LORAIN SELF-PROPELLED MODELS

MODEL	CARRIERS	LIFTING CAPACITIES	SHOVEL CAPACITIES
SP-107	4x2, 4x4	7 tons	3/8 cu. yd.
SP-110	4x2, 4x4	10 tons	1/2 cu. yd.
SP-254	6x4	15 tons	3/4 cu. yd.
SP-254W	6x4	17 1/2 tons	3/4 cu. yd.
SP-424	6x4	22 1/2 tons	
SP-530	6x4	30 tons	
TSP-530W	8x4	35 tons	
TSP-875	6x4	75 tons	

A complete line of conventional, long wheel base Self-Propelled models also is available in the Lorain line. Available from 10 to 75-ton capacities, in single-engine and twin-engine types. 2-, 3- and 4-axle carriers available.



The Thew Shovel Co., Lorain, Ohio

Will your new shovel-crane stay up-to-date?

If you haven't bought a machine backed by a sound, progressive parts program, it quickly can become out-of-date, less efficient than your competitors', more costly to operate, robbing you of jobs and profits as newer, more modern models are produced.

If you buy a Lorain, you can look to Lorain to protect your investment by providing specially selected "Parts Kits" to enable you always to bring your machine up-to-date to match current production designs and improvements . . . to enable you to convert a complete assembly from an original design to another of a more modern design or purpose . . . to save you money when replacing assemblies or subassemblies. Lorain Parts Kits frequently will cost you less for an entire assembly than for the replacement of a few parts.

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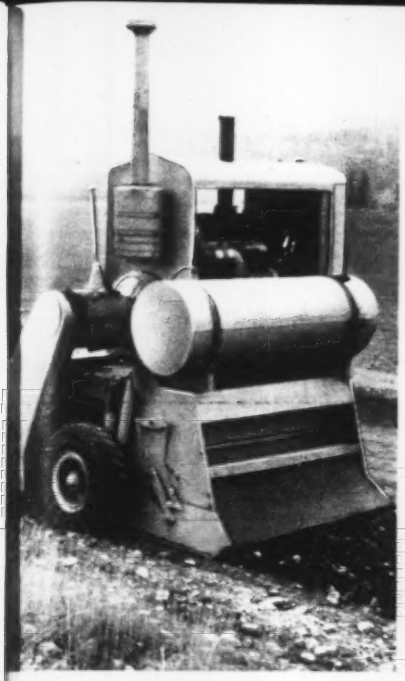

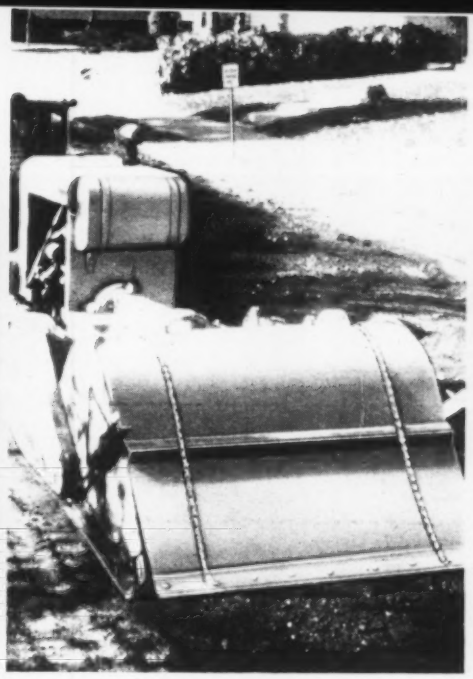

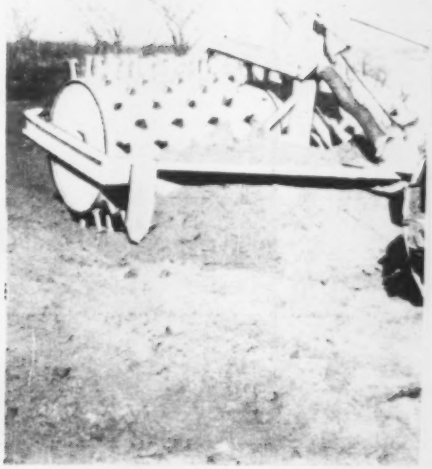

Bros shows Road Builders 3 ways to reduce roadbed costs in '57

Subbase and subgrade materials from native or over-size rock

Montana photo (left) shows how the Bros PREPARATOR is making substantial savings on subbase costs by reducing native rock at the rate of up to 400 cu. yds. per hr. 22 special alloy steel hammers driven at high speed break rocks along cleavage lines; accepted gradation percentages and clean, sharp angles of friction result in the materials produced. Easily handles up to 24" diameter stuff. It can be towed by any 40 to 50 HP tractor.

This machine is also a real money-maker in pulverizing old blacktop materials for re-use. Reduced to uniform size, materials are easily blended with new asphalts.

Base and surface course materials mixed faster and to greater depths

Minnesota photo (center) shows the Bros ROTO-MIXER using every bit of its "beef" in mixing old road materials full of big rock, slab-like asphalts and cobblestones; heavy-duty design brought it through without damage. The machine features a 6" solid steel rotor shaft; simplified split-sleeve tool plates, load absorbing tool sockets, variable speed transmission and independent hydraulic control of the hood and the rotor.

These features add up to correct control of mixes, minimum of repair and breakdowns and deeper and faster mixes.

Earthfill materials bladed and compacted in one operation

Minnesota photo (right) shows Bros LEVEL BLADE ATTACHMENT combining grading and rolling into one operation on a regrading project. This dual effort eliminated a patrol grader from the embankment job. Consolidation allowed scrapers to run in high gear; two to three extra hauls per hour were reported. Equal or greater densities than giant tampers achieved on this project also resulted from this combination blade-roller work.

Consolidating old roadbed materials in a horizontal stockpile with the blade-roller permits scrapers to spread on top without bogging down. Spring-loaded blade has 7½" vertical adjustment for cross-overs and grading in gumbo.

• • •

Cost savings vary from job to job, but the best way to make maximum savings on roadbed construction is by putting this Bros equipment to work for you. (And don't forget about our tremendous pneumatic tired roller line.)

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75TH YEAR

ROAD MACHINERY

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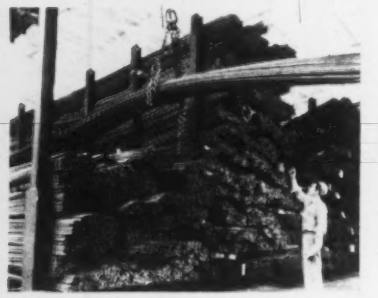
CONTRACTORS GUIDE to Ryerson Steels and Services

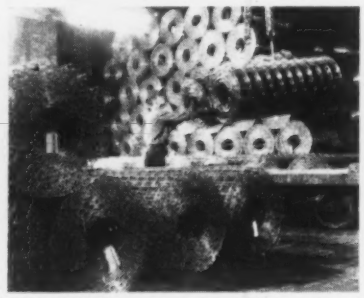
Supply problems are delaying many construction projects today, but you can keep jobs moving ahead unhampered by steel shortages when you build with reinforced concrete—and depend on Ryerson reinforcing service.

So for your buying convenience here's a quick review of Ryerson steel products—all in good supply—and Ryerson services for contractors—all readily available to you.

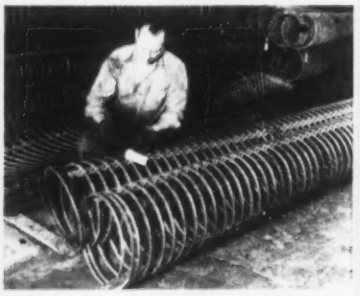
See your Ryerson Steels catalog for the complete list of products—including all construction steel accessories, threaded bars, turnbuckles, caisson rings, etc., and write for our bulletin (No. 70-2) on specialized reinforcing service.



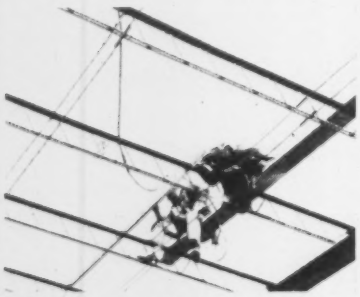
RE-BARS—New billet, deformed reinforcing bars in stock at 15 Ryerson plants. Designed for highest bonding power, bars conform to all building codes and to ASTM specs. A-15-52T and A-305-50T.



WIRE FABRIC—Electric-welded fabric of cold drawn wire in rolls available from stock in a wide range of standard gauges and spacings. Special gauges and spacings furnished to order.



SPIRALS, for column reinforcement—Made from hot rolled wire rod or cold drawn wire in ¼", ⅜", ½" and ⅝" diameters complete with channel spacers. Collapsible for shipment.



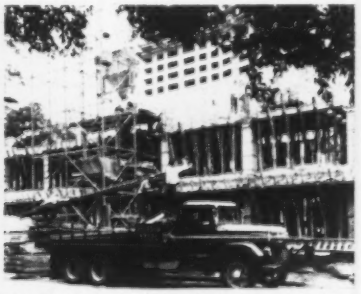
OPEN WEB STEEL JOISTS—All welded, designed for maximum strength, minimum weight in accord with Dept. of Commerce standards. Available in 4' to 40' lengths and 8" to 20" depths.

DETAILING—Expert Ryerson detailers can furnish complete setting diagrams and bending details that effect substantial reduction in re-bar placement costs.

FABRICATING SERVICE—Modern equipment and competent personnel to cut, bend, weld, thread or otherwise prepare any tonnage of construction steels are ready to work for you at Ryerson.

POSITIVE IDENTIFICATION—Permanent tags that cannot be defaced or torn off accurately identify every piece of Ryerson reinforcing steel—so correct placement on the job is quick and sure.

STEEL FORMS for concrete joist construction—Standard removable steel forms, slip or nail-down type, furnished in 20" or 30" widths. Special filler forms in widths of 10, 15, 20 and 30 inches.



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THE CONSTRUCTION WEEK

EGYPT NEEDS A CONTRACTOR—A hitherto overlooked casualty of the Suez Canal crisis is the power plant construction job Egypt was doing at the Aswan Dam—not the proposed High Dam, but the existing one. The contractor was the French construction firm, Societe des Grands Travaux de Marseille, whose position became untenable after the British-French troop landings. That Egypt is shopping for a new contractor is indicated by a dispatch from Stockholm stating that a Swedish company had turned down an Egyptian offer for it to take over the power plant construction.

CANADIAN NATIONAL ENERGY BOARD—Preliminary report of a Royal Commission on Canada's future economic prospects recommends creation of a national energy authority that would determine long-range policy on hydro power, gas, oil, coal and atomic energy. Roughly comparable to the U.S. Federal Power Commission, it also would regulate export of these resources. This point, together with Constitutional problems, makes establishment of the agency by the Dominion Parliament extremely doubtful in view of the present government's stand against further exports of power.

MORE DIVERSION NEEDED—On Jan. 19 level of the Mississippi River at St. Louis was minus 4.5 ft, which corresponds to a channel depth of 7.5 ft. Barring substantial rainfall, the Corps figures this level to hold through January but to drop to minus 5.5 ft by mid-February if the temporary diversion of an additional 7,000 cfs from Lake Michigan halts on Jan. 31 as scheduled. However, Illinois already has asked the U.S. Supreme Court to extend the increase authorization another month and approval is likely.

FLOOD CONTROL COMPACT COMING?—Gov. Lane Dwinell of New Hampshire is said to be preparing a message to his legislature, seeking a flood control pact between New Hampshire and Massachusetts. This would give the federal government long-awaited permission to construct a $34-million flood control reservoir on the Contoocook and Piscataquog Rivers. The dam, according to Corps of Engineers, would give substantially increased protection for the highly industrialized Merrimack River from Concord, N. H., down to Newburyport, Mass. The Corps has told the governor that while the federal government is prepared to build the project, under a departmental policy at Washington nothing can be done until the state legislature gives its official sanction. Congress, of course, will have to give final approval.

GOODYEAR WAS THERE!

GLENDO DAM "OPERATION REVERSE" WELL AHEAD OF SCHEDULE

HARNESSING THE NORTH PLATTE calls for reversal of usual dam-building procedure. A 21-foot-diameter, 2100-foot-long tunnel had to be bored *before* main construction — together with other preliminary work. The various contractors coordinated so well that almost *half* the scheduled work—tunnel AND dam — was completed in *one-third* allotted time. Picture shows equipment on Hard Rock Lug tires by Goodyear tackling 4½-million-yard haul.

WIDE-BASE TYPE SURE-GRIP LUG gets careful inspection—as do all tires on this fast-stepping job. Nearby Goodyear facilities keep tire inventories down and provide quick repair and recap service.

End your tube and flap troubles with Goodyear

TUBELESS TIRES!

STANDARD ON FOREMOST ORIGINAL EQUIPMENT, Goodyear *tubeless* tires and rims are proved the most airtight assembly. They may be specified for even the largest vehicles.

ADVANTAGES ARE MANY: Tube and flap troubles, tube replacements, are ended. Mounting is simple, safe and sure. Injuries are easily detected —and tire failures and down time drop to record lows.

Just be sure you specify GOODYEAR Tubeless on new equipment—or for economical change-over, for replacement, see your Goodyear dealer. Goodyear, Truck Tire Dept., Akron 16, Ohio.

Buy and Specify **GOODYEAR**

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

All-Weather, Road Lug, Sure-Grip—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

NOW IN 3-T NYLON CORD — *TUBELESS* OR TUBE-TYPE!

SURE-GRIP LUG

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ROAD LUG

ALL-WEATHER EARTHMOVER

GOODYEAR TIRES

Look for this nearby Goodyear dealer sign for better tire values—better tire care.

WASHINGTON OBSERVER

Numerous construction measures are being asked of Congress this year. During his first four years, Eisenhower began many projects—military and civilian—which show up in the large increases in spending laid out in his budget for the year beginning next July 1 (see page 46).

A dozen or more pieces of legislation are needed, the President says, to take care of specific problems.

•

A new request for authorization of the $156-million Frying-Pan Arkansas Project will be backed by the Administration. It's the biggest single project the President wants to be authorized. Chances are only fair for final approval this year, but it should look better to Congress than it did a year ago. Reason: drought and the election results in the West last fall.

Corps of Engineers would like to begin projects already authorized: the $100-million Allegheny River reservoir crossing the Pennsylvania-New York boundary, and the $11.8-million North Hartland, Vermont, reservoir.

One project under consideration involves the high Pleasant Valley Dam on the Snake River in Idaho. Secretary of Interior Seaton is asking the Federal Power Commission to postpone ruling on an application for two low dams to be built by private companies while he decides whether to recommend a high dam at the Pleasant Valley site (ENR Dec. 20, 1956, p. 19).

•

A big chunk of school construction depends on how Congress reacts to the Administration's proposals—on public schools, mainly.

Actually, requests for medical and dental teaching facilities stand a much better chance than does the Administration's plan to pump federal money into public schools generally. The medical-dental school program is relatively small; with the program for building research facilities, it totals around $250 million over a five-year period.

The segregation issue is hotter than ever on public schools. Hence, Eisenhower's plan to back a $2-billion federal program in four years isn't likely to get much farther than it did last time out.

•

Smaller cities would get a break in starting urban renewal projects under an Eisenhower proposal. He would relax the stricter requirements on slum prevention that now apply across the board to all cities of all sizes.

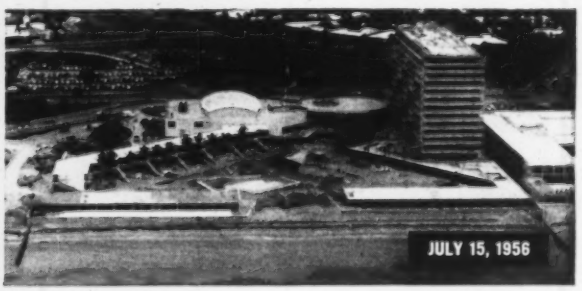
There's a strong hint favoring easier terms on FHA mortgages in the budget message. This is taken to mean that the Administration will back down payments (perhaps as low as 2%) for houses up to $9,000, say. It's the kind of move that might help take care of the veterans program—now hung up on lack of funds because of the lower VA interest rate. Eisenhower asked that the VA rate be raised.

Fanny Mae will get more money to buy mortgages. The agency needs $350 million more by March to maintain its secondary market for mortgages. For the next fiscal year, another $350 million is requested. Congress will approve. It also will approve Treasury buying $100 million of FNMA preferred stock. This has the effect of expanding Fanny Mae's mortgage purchase authority by $1 billion.

•

The pressure is on for building commercial reactors for electric power. The President reiterates what AEC Chairman Strauss asked for earlier: a federal construction program—which would run into hundreds of millions of dollars—if private industry doesn't step forward with proposals. This comes closer to the view the Democrats have been pressing. A big surge of atomic power plant construction seems near at hand.

Floor-a-Week Frame Construction . . . 50% Form Saving



ENCORE FOR 'INCOR' This year's big news on South Florida's Gold Coast is the amazing Americana. Architect Morris Lapidus, who designed the Fontainebleau in 1954 and Eden Roc in 1955, has endowed the Americana with a distinction all its own, by blending touches of decor from all the Americas. Matching brilliant design is the staunch, fire-safe concrete construction, and newsworthy indeed is the Contractor's performance in completing this far-from-simple design in record time.

Miami Beach prohibits building December through March. So construction from foundation to lobby floor of the 15-story, 475-room guest unit was completed September through November. Resuming construction April 1, the Contractor went onto a high-speed 'Incor' schedule on the superstructure, to assure early-December opening.

Forms filled with concrete one day, stripped and jumped the next . . . structure topped out July 15 . . . 14 stories and roof erected in as many weeks. Typical 'Incor'* results: 50 to 60% saving on forms . . . faster completion, less job overhead . . . earlier rentals . . . quality concrete, with high ultimate strength matching high-early performance. Duplicating similar record on Fontainebleau and Eden Roc . . . another encore for 'Incor.'

*Reg. U. S. Pat. Off.

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Architects & Designers: MORRIS LAPIDUS
LEO KORNBLATH, Associate
New York-Miami Beach

Structural Engineers:
OBOLER & CLARKE, Miami Beach

Contractor:
TAYLOR CONSTRUCTION COMPANY, Miami

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LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS: 18 MODERN MILLS, 38,200,000 BARRELS ANNUAL CAPACITY

President Eisenhower went into the Southwest to survey the effects of drought. He saw the drastic effects of a 10-year rain deficiency over a wide agricultural area.

Now he ponders . . .

What to Do About a 10-Year Drought

President Eisenhower didn't need to make last week's flying trip to six southwestern states to learn the effects of prolonged, persistent drought over the nation's Great Plains area. But the fact that he made the trip served to revitalize (and emotionalize) the nation's thinking on a problem that has been with us for years.

As the President's trip ended in Wichita, Kan., he assured an audience of farmers and ranchers that "it is a problem . . . we will solve." But it was more evident than ever to the nation as a whole last week that there is no quick and easy solution to a problem that has grown up to disaster proportions in many areas.

Immediate step likely was action on a pledge to seek a $76-million relief fund.

From the engineering viewpoint, however, alleviation from drought suffering rests not in relief funds, but rather in funds for construction of projects that will put what water there is into places where it can best support human and economic life. Clues to these partial solutions to a problem—which can be solved totally only by rain, lots of rain—are to be found in the President's budget message (see p. 46). The budget was prepared prior to the drought-area inspection trip, but was written, of course, in full appreciation of the situation that presently exists.

Whether the President and his party of Cabinet and sub-Cabinet experts found any evidence of past failure on the part of engineers to design and to promote the facilities, which might now be easing the drastic effects of drought, has not been reported. Nor has there been any indication that the Administration, as a result of this trip has developed or will develop any grandiose water supply or irrigation schemes. But certainly long-range planning of engineering works to conserve, store and move water will be a part of the overall program, which surely will come out of the trip.

• **More money in the budget**—Best indication of what's immediately ahead are the budget items aimed at drought relief:

For the "small" watershed protection activities, in which the Soil Conservation Service takes a financial share with local groups building reservoirs, President Eisenhower is asking this Congress to appropriate $111 million, up from an estimated $93 million that will be expended in the present fiscal year.

Besides this, the new budget proposes $202 million of expenditure for the Bureau of Reclamation, which, among other things, will start six new irrigation and water-supply projects. The bureau has an estimated outlay figured at $176 million for fiscal 1957. Thus, the fiscal '58 proposal represents a 15% increase.

But what water-short, drought-conscious states and cities likely will look forward to with even more interest is seeing precisely how the federal government will proceed to give meaning to this Eisenhower statement:

". . . Where feasible and in the public interest, non-federal interests will be encouraged to participate with the federal government in certain previously authorized projects now in various stages of planning or construction (by Corps of Engineers). . . . Similar partnership arrangements are being considered by the Bureau of Reclamation."

• **Partnership possibilities**—This is not an entirely new concept. The Northeast Texas Water District, a combine of seven towns in the industrialized region, which surrounds the big Lone Star Steel plant in East Texas, already is participating with the Corps in the Ferrells Bridge Dam and Reservoir Project. Basically, it is a flood control project, which explains the Corps being involved in the first place. But the seven municipalities in the water district are paying 19% of the cost—their

. . . Conditions vary, but are bad all over

Arizona

Suffering from drought since 1942, Arizona wound up 1956 with some of its lowest river flows since 1914. The Little Colorado River near Cameron ran dry in September, stayed dry through December. Groundwater levels are declining as surface sources go dry and wells carry full irrigation loads, according to the U. S. Geological Survey.

New Mexico

Also suffering since 1942, New Mexico's present plight is evidenced by Elephant Butte Reservoir being down to 5% of its 18-year average storage. Groundwater levels were at or near record lows for December as result of increased well-water irrigation.

Texas

Flow of the Trinity River below Forth Worth and Dallas is being maintained by sewage effluent. Dallas water supply is being pumped from the Red River and East Fork Trinity River. Water level in key wells was record-low for December, mostly due to increased pumpage—only indirectly due to the drought.

Oklahoma

Streamflow continues to be deficient, after 1956 chalked up a new record low for runoff. Well-water levels in northeast are lowest in 21 years.

Kansas

Municipal water supplies are not as bad off as in 1953, but this is because of improvements that have been made; water resource conditions are at their worst. In December, record lows were hit on all key wells and gaging stations. The Kansas River at Topeka was its lowest since 1917.

Colorado

Runoff hit a record low in the Arkansas River at Pueblo, and total flow of this river for all of 1956, measured where it crosses into Kansas, was the smallest amount since 1949. Groundwater levels continue to drop under heavy irrigation pumpage.

Utah

Severe drought in the southern part of the state is the result of seven years of rainfall deficiency. The surface water situation hasn't been so bad since the Thirties; groundwater conditions are bad all over and at their worst in southwest corner of the state.

Nebraska

Groundwater levels are so low that streamflow—entirely groundwater effluent at this season—is also seriously low.

Iowa

With western farmers buying water from cities, cities are drilling extremely deep wells for additional water supplies, as drought prevails.

Missouri

Runoff stays low over the entire state, but the real trouble is low runoff upstream, causing problems of navigation, power and water supply at and around St. Louis.

share now is estimated at about $2.2 million—and will get 19% of the water stored.

This concept is beginning to appeal to Texas state political figures who have for years flinched at the idea of joining the federal government in water development. In Austin, legislative water experts are considering raising state money to join in building reservoirs; the federal government would build for flood control, the state would add money to make dams higher and hold water for conservation purposes, municipal and industrial uses.

Just as a starter, the state legislature of Texas is being asked this year to set up a $100-million program to help communities that have no federal water projects. This money would be used as a guaranty behind the bonds of local communities needing to build reservoirs. An additional $10 million a year is being asked to finance conservation storage additions to federal projects, existing or future. The federal government will not build for conservation storage alone.

• **Water for whom?**—Behind any long-range planning to bring the Plains States out of their present drought-caused troubles is one very basic question: Should the area's aim be to get back to the ranching and farming of better water years, or is the industry, which has grown there, to stay and to supplant dependence on the soil? Should the water available after human needs are met best go for industry or irrigation?

Speaking to irrigators in Denver just two weeks ago, Assistant Secretary of Interior Fred G. Aandahl had this to say:

"Our growing population, our constant urban, industrial and highway encroachment on agricultural land, and our specialized and broadened dietary requirements in a few years will change us from a nation of agricultural surpluses to one exerting special efforts to produce sufficient food and fiber. Irrigation, which provides highly increased production on well cared for land, is one of the best potentials on which to place those efforts."

On the other side of the question there has been the warning of Harvard Professor Gordon Fair that attempts to raise farm income through increased irrigation may block the more profitable—to the overall economy—use of water for industrial production (ENR Apr. 12, 1956, p. 32).

Here is what has happened already in the drought area, to evidence the shift from agriculture to industry, which has been drought-induced:

Just when natural forces were dis-

rupting agriculture, man-made forces were touching off an industrial and business boom. Aluminum Company of America found itself hiring heavily for its new Texas plant from a conglomerate of mainly peanut and cotton farmers.

Aircraft plants of Wichita, Tulsa and Fort Worth and the numerous military installations that dot the region were finding farmers for civilian jobs.

At present, the Suez crisis is stimulating the oil industry, the economic cornerstone in Oklahoma and Texas and almost equally important to Kansas and New Mexico—with the effect everywhere to pull the farmers off the farms.

One observer says: Don't minimize this—the drought has been a calamity for our farmers and ranchers. But if water conditions had been perfect, we probably would have had to import more people for southwest industry.

When the rains come back will the farmers rely again on the land, causing an unstable labor market? In Tulsa, a Douglas Aircraft official says: "We don't regard this as a short haul proposition. They left the farms for economic reasons, and it will never be economically feasible for them to return." A Dallas banker offers the same conclusion in these intriguing words: "I don't think dryland farming in this (part of the) country will ever look attractive again."

• **The brighter side**—Not everything is black, however, in the drought-stricken area. Construction projects undertaken and water and soil conservation measures applied since the great drought of the 1930s make the overall situation less critical now than it was, despite the fact that the present shortage of moisture is even worse in some places than it was two decades ago.

Projects completed or partially operatable are supplying water to municipalities and industries, which would otherwise be short. Reservoirs built in the Missouri River Basin by the Bureau of Reclamation and the Corps of Engineers, for example, are providing emergency water supplies to municipalities and farmers through such distribution systems as have so far been built. Similar projects are giving limited relief to important areas in the great drought area south and west of the Missouri Basin.

Along with the larger construction works installed by Reclamation and the Army Engineers, watershed projects of the Soil Conservation Service already have had some effect in retaining scant moisture. Results in the threatened dust bowl will become more apparent as additional projects now being started approach completion.

All plans for combatting recurrent drought in the vast dust bowl are necessarily long range. It takes years to develop effective plans to carry them out. That fact applies to all the projects now being studied, planned and built by federal construction agencies.

In the six badly hit states that the President visited last week, Reclamation has a dozen operative projects that now are supplying priceless water to municipal systems, which have top priority, and to farmlands. Additional important projects are in prospect, some of them already authorized and others still in the study stage.

First on the list for likely authorization is the Irving Pan Arkansas $156-million transmountain diversion project in southeastern Colorado. This development would assure water for nine municipalities and 300,000 acres of irrigated land. The Administration has renewed its plea to Congress for approval and starting money this year.

Soon to be submitted to Congress is a recommendation for the $30-million San Angelo Project to supply this water-short west Texas city and irrigate 10,000 acres. Far bigger is the proposed $1-billion Gulf Basin Project, which would divert surplus water from east Texas rivers through a 430-mile canal to the dry southern part of the state (ENR July 23, 1953, p. 24).

Already authorized is a Canadian River dam and aqueduct system to supply eleven cities in the Texas panhandle. These cities now tap an adequate groundwater supply that will need to be supplemented from surface sources in the future.

Elsewhere in the hardest hit drought area, Reclamation has a sizable list of potential projects. A half-dozen are under construction, and as many more are definitely scheduled to start in the next few years, with the $40-million Washita Project in Oklahoma to get under way this year.

The Army Engineers have completed more than 25 dams that help to counter the effects of the dry years. Another group of some 25 Army Engineer dams has been authorized by Congress for future construction in those states.

Watershed projects of the Soil Conservation Service likewise are resisting the effects of the drought, which already has put 29 million acres of Great Plains land in condition to blow.

The only sure thing right now, as far as results of the trip are concerned, is that public consciousness is aroused and governmental concern will be sustained until some immediate and some long-range ways to ease pains of long droughts are evolved.

Publish Standards for Road Bridges

Interim Federal Highway Administrator John A. Volpe has announced the release of a new edition of the Bureau of Public Roads' publication, "Standard Plans for Highway Bridge Superstructures."

The 53-page book comprises 18 series of standard plans that furnish details for a variety of types of highway bridge superstructures. Entirely new in this edition are three series for pretensioned precast concrete structures and five series for structural timber. From the previous (1953) edition, with revised and modernized designs, are series for I-beams, riveted or welded plate girders, reinforced concrete slabs, T-beams, box girders, precast concrete decks, and post-tensioned precast concrete I-sections.

The drawings give complete information so that they approach contract drawings as nearly as practicable.

The designs are based on two widths of roadway: 24 ft with H-15-44 live load and 28 ft with H20-S16-44 live load. The ranges in span lengths, from 11 to 140 ft, are based on the economy and suitability of each particular type of superstructure.

The publication, "Standard Plans for Highway Bridge Superstructures" (1956 edition) is available from: Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

• **Pennsylvania plans**—Coincidentally, the Pennsylvania Department of Highways completed a somewhat similar publication. It is the first time in the department's history that standard bridge plans including complete design of bridges with all necessary details have been developed.

The standard bridge plans are divided into two parts and have been organized in such a manner that they can be utilized immediately on the state's federal highway program. The first part of the plans consists of 13 drawings with details suitable for use on all bridges. The second part consists of 55 drawings of all types of standard structures.

Bridges in the standard structures include spans from 20 to 80 ft in reinforced concrete slab, reinforced concrete T-beam, steel I-beam, composite I-beam and prestressed concrete types.

Highway Secretary Joseph J. Lawler estimates a cost saving of about 20% on bridge construction.

The bridge design program was initiated during the flood emergency in northeastern Pennsylvania in 1955. When Lawler was apprised of the number of bridges that had been destroyed, he found that the department was without standard plans that could be used to construct a bridge when the materials became available.

Federal budget analysis shows . . .

Construction Will Take a Big Bite

If President Eisenhower has his way entirely, about 89 of every $100 the federal government spends in fiscal 1958 will go for public works.

That is the big impact of the whopping budget for everyone in or on the fringes of the construction industry.

Looked at one way, it's this: $6.3 billion proposed for public works out of an overall total of $73.1 billion for all purposes.

Looked at another way, it's this: Involved is about 13% of all U.S. construction. Direct federal construction constitutes about 7.5%; federally aided state and local public works construction constitutes another 5.5%.

The overall public works increase for fiscal 1958 represents about 25% from fiscal 1957, in which the indicated final total is to be approximately $4.9 billion.

Total federal impact on construction is even larger. Including gross loans for public housing and grants to semi-public non-profit projects, overall federal construction disbursements are budgeted at $7 billion in 1958 (see table). This total compares with $5.6 billion in the current year and $4.6 billion last year.

One thing to remember: These are only Administration requests. There are political considerations, so the logical following question concerns Eisenhower's chances for getting what he wants. This week, his chances for getting Congressional acquiescence in his public works program look generally bright.

However, the $6.3-billion total does include $185 million that must be labeled from the outset as very dubious. That's the amount that the Administration wants to pump into a beginning for its pretentious program of federal aid to school construction. The program seems destined once more to be wrecked in a bitter, deep-seated Congressional fight that stems from southern resistance to public school racial integration.

The principal reasons for the startling 25% growth of the fiscal '58 budget are two: (1) the greatly enlarged federal aid highway program, and (2) increased expenditures for military construction and water resources projects.

It is hardly surprising, therefore, to observe that civil public works are figured to jump from $2.38 billion in fiscal 1957 to $3.70 billion in fiscal 1958. National security works—both military and atomic energy, etc.—also will rise to $2.55 billion in the coming year, against $2.28 billion in fiscal '57.

Big though it is, the public works budget might conceivably have been much higher except for the Administration's fear of an inflationary spiral.

Eisenhower himself put it in these words, in a message covering the budget: "... In view of the present active competition for labor, materials and equipment, I am not recommending some other desirable construction projects, and I have asked the head of each federal agency to watch closely the timing of construction and to postpone work which can be appropriately put off until a later date."

Administration spokesmen declined to be drawn out on which specific projects were pulled back this year because of the inflationary threat.

I. The Future Program

The outlook for future years in public works is potentially more impressive than is likely to come about in fiscal 1958. As of now, a detailed budget analysis shows, the various agencies have a reserve of $12 billion in unstarted, but authorized, projects—that is, authorized by Congress in either specific or general legislation. Of this total, about $12 billion is represented by 648 projects falling within the province of either the Corps of Engineers or the Bureau of Reclamation.

Another impressive item: Plans by the end of 1957 will have been pushed to the point where the agencies could, on almost instant notice, push the button and start work on an estimated $1.7 billion of federal construction projects. Planning by the same time will be far advanced—although still short of the point where actual work could start—on another $4.7 billion worth of projects. These items are known as "the planned reserve."

Most of this planned reserve consists of water resource projects. But the Budget Bureau notes additionally that "a substantial amount of planning will also have been done by state and local agencies on highways, airports, waste treatment facilities and hospitals, for which federal grants are authorized."

II. The Current Program

As Eisenhower laid it down, the '58 budget contains $1.5 billion for continuing work on civil projects that are already under way or will be before the end of this fiscal year. In subsequent years, the Budget Bureau calculates, another $6.2 billion will be needed to complete these works.

They include, among other things, a number of water resources projects being constructed directly (that is, without any outside financial participation) by the federal government.

Also included are such things as construction of roads and other facilities in national forests and parks (a program that is envisioned for continuation over a number of years) and a variety of federal aid programs which have an expected long life also.

New projects and programs in fiscal 1958 are allotted expenditures totaling $405 million. Another $1.6 billion would be required in subsequent years to finish these.

Among these new projects are 30 for major water resource development, authorized by prior Congresses and now needing only appropriation of funds for construction to commence, plus up to $5 million for small projects which, by budget definition, means those costing less than $400,000 each.

Two new federal penal institutions and two new veterans hospitals (at Jackson, Miss., and Nashville, Tenn.) are among the building projects that the Administration is asking to get started.

Moreover, it is once more asking Congress to give the Bureau of Reclamation $1 million to start construction of the Irving Pan Arkansas project.

Other legislative proposals that are concerned with the civil public works program would:

- Set up loan and grant funds for local groups undertaking construction of small reclamation projects.
- Permit the Tennessee Valley Authority to add one steam-electric generating unit at an existing plant.
- Give the Corps of Engineers $5 million for federal participation in partnership water resources projects.

III. Corps of Engineers

For direct federal construction projects, the Corps of Engineers is budgeted at $497 million of spending during the coming fiscal year.

In broad outline, this is the Corps program:

- Push flood control work in the Northeast and the Far West, started in 1956 and 1957.
- Continue construction work on the Mississippi River and its major tributaries.
- Carry on with work, already in progress, on 24 multiple-purpose projects—including two additional power generating units at Table Rock Reser-

voir and five additional power units at Oahe Reservoir—and on 117 other projects that are predominantly for flood control. These latter include 16 projects in the lower Mississippi Valley.

• Move forward with construction of 87 other projects, mostly navigational, and aim for completion of at least 30 of them before July 1, 1958. Among the 87 projects are the Great Lakes connecting channels, the Delaware River channel to Trenton, and several units in the Ohio River lock and dam network.

• Try to get started with 13 new, local flood protection projects; initiate three new flood control reservoirs; and add new power generating units to the Bull Shoals Reservoir of Arkansas and Missouri.

IV. Bureau of Reclamation

The Administration proposes to give the Bureau of Reclamation $144 million for its program of developing water resources in the 17 western states of the country.

This is the outline of the bureau's program:

• Go ahead with construction, already under way, at 71 irrigation projects—including 21 units in the Missouri Basin project, and three in the Colorado River storage grand plan—and rehabilitation of 10 projects constructed in earlier years.

• Shoot for beginning of construction on three new projects in the Missouri Basin program.

By the end of the fiscal year, the bureau expects to have provided full quantities of irrigation water for 168,400 acres not now irrigable and to have developed supplemental supplies for 87,600 acres already under some degree of irrigation.

V. Tennessee Valley Authority

The TVA's construction spending for fiscal 1958 carries an estimated price tag of $119 million. This will pay for beginning construction of one new steam generating plant, continuing construction on seven similar units started in 1956 and '57, and for finishing on five steam-electric plants already in operation.

Additionally, the budget calls for TVA to build transmission lines for marketing of the additional power it will be able to generate and to go ahead with construction, now under way, on a lock at Wilson Dam.

VI. Public Roads

Probably the biggest significant change in current public works philosophy is represented in this year's spending for highways: the creation of a highway trust fund. This bookkeeping device means that by law all revenues from specified highway users' taxes are exclusively devoted to highway construction.

These taxes—which the federal government has collected for years—include excises on gasoline and other fuels, autos, tires, recap rubber, and the like. But up to now they have been part of the general revenues of the federal government, to be spent wherever the Congress chose to appropriate the money.

This coming year for the first time, these taxes are scaled off in a separate kitty which can be tapped only for federal-aid construction, with emphasis on the 40,000-mile interstate highway network. Also for the first time, the federal government is contributing 90% of the cost of the construction of the interstate system, the states 10%. The 50-50 matching arrangement will remain in force on the other systems.

The net result of the creation of the trust fund for the new multi-billion, 13-year highway construction program is a sharp rise in spending for highway construction. Spending for fiscal 1958, beginning next July 1, will more than double that of the year ending last June 30.

The figures for all federal aid highway programs covering the primary, secondary and interstate systems: fiscal 1956, spending will be $728.1 million; for the current year, $1.14 billion; for next year, $1.65 billion.

With the creation of the trust fund, the only highway money now proposed in the so-called "regular budget" is for such things as forest highways. This year this spending amounts to $44 million; the new budget proposed $42 million for next year.

The spending picture on highway construction is about the one that has been projected up to now: The money accumulating in the fund from highway users is considerably more than the states are able to absorb and spend. Hence, you find that collections in the highway fund are expected to be $1.5 billion for fiscal year 1957, with outlays totaling $1.1 billion. In the year

BUDGETED FOR CONSTRUCTION

Civil Works

Agency	1956 Actual	Fiscal Year 1957 Estimate (In Millions)	1958 Estimate
Bureau of Public Roads	$770.5	$1,170.9	$1,695.5
Corps of Engineers	406.2	456.5	521.0
Department of the Interior:			
Bureau of Reclamation	124.3	132.7	160.5
Bonneville Power Administration	27.7	24.4	26.1
Bureau of Indian Affairs	22.1	21.8	25.7
National Park Service	21.6	52.5	47.8
Other	25.3	33.2	29.5
Tennessee Valley Authority	62.4	88.6	123.0
Saint Lawrence Seaway Development Corp	9.2	47.7	48.2
Housing and Home Finance Agency			
Loans, Low-rent Public Housing (Gross)	237.2	466.0	328.6
Loans, College Housing, Public Works, Etc.	17.9	47.0	97.7
Dept. of Health, Education and Welfare			
Office of Education	94.6	67.6	289.3
Public Health Service, Etc	29.3	57.7	128.6
Veterans Administration	25.8	46.2	36.6
Department of Agriculture	57.5	81.3	113.1
Civil Aeronautics Administration	26.8	87.3	140.1
General Services Administration	17.7	41.2	79.5
Architect of the Capitol	7.0	25.5	33.7
Other	39.6	76.4	109.6
Total for Civil Public Works	**$2,022.7**	**$3,034.5**	**$4,034.1**
Expenditures for Cooperatives and non-profit groups	259.0	322.0	401.8
Total, Civil Works Construction	**$2,281.7**	**$3,356.5**	**$4,435.9**

Defense

Air Force	1,347.0	1,114.0	1,249.0
Army	416.6	464.9	415.9
Navy	235.1	419.0	425.5
Interservice Activities	53.5	39.2	1.5
Defense Department, Proposed Legislation			232.0
Atomic Energy Commission	243.4	236.5	202.8
AEC, Proposed Legislation			30.0
Expansion of Nickel Plants, Nicaro, Cuba	23.5	8.1	
Total, Defense Construction	**$2,319.1**	**$2,281.7**	**$2,556.3**
Total, Federal Construction	**$4,600.8**	**$5,638.2**	**$6,992.2**

beginning July 1, the trust fund will collect $2.2 billion, with outlays to the states expected to include $1.8 billion of this amount.

VII. Military Construction

After holding steady at $2 billion a year since fiscal 1953, federal spending for military public works is budgeted to increase some $300 million in fiscal 1958.

Best estimates obtainable indicate that about 75% of the expenditures will be in the continental U. S. and the remainder overseas, as in recent years.

Air Force construction will get close to 60% of the money to be expended in 1958, with Army and Navy projects dividing the rest, about 20% for each of the two services.

A portion of the projected expenditures, some $230 million, will be paid out in monthly estimates on new projects, not yet authorized, that will be started during the fiscal year. Congress is expected to approve these projects, already programmed, in the military construction bill being readied for the present session.

Plan: End Main Street Runs For Philadelphia Transit

As a result of a $50,000 survey, a plan is now before Philadelphia officials that could change completely the present traffic picture in the city's shopping and business district.

Recommendations, made by the firm of Wilbur Smith & Associates of New Haven, are:

- To ease congestion on Broad St., mass transit vehicles should be eliminated from six north-south arterial streets and private traffic diverted to these avenues. All bus and streetcar traffic would be taken off Chestnut and Walnut Sts. to make them arteries for private traffic to and from West Philadelphia. Market St. would be restricted to mass transit as far as possible by drastic regulation of private motor traffic. Sansom St. would serve primarily as a loading area for Chestnut and Walnut St. business firms.
- Police should be given "adequate authority" to enforce regulations designed to establish safe and efficient pedestrian movements at central city intersections.
- The central city's 345 traffic lights should be synchronized to permit traffic to move at a steady 20 mph.
- Severe parking restrictions and no-stopping regulations should be imposed on all designated arterial traffic routes to speed the flow of private cars.

The consultant also recommended consolidation of some trolley routes and banning of all turns on mid-town streets at certain peak traffic periods.

Beaver Awards

Eleven are honored in Los Angeles at annual session

Eleven construction industry personalities were honored in Los Angeles last week by The Beavers. The group, in its second year of operation, includes among its membership most of the leading construction men operating west of the Mississippi.

Three special awards were made at the Jan. 17 awards dinner, which was attended by more than 1,000. One went, posthumously to William A. Johnson, first president of The Beavers, who at the time of his death was chairman of the board of American Pipe and Construction Co. Other special awards went to Lt. Gen. Samuel D. Sturgis, Jr., recently retired chief of the Corps of Engineers, and Robert B. Diemer, general manager and chief engineer of the Metropolitan Water District of Southern California.

Awards in the management category went to W. F. Kier of Kier Construction Co., San Diego, and W. J. Rohm, Winston Brothers Co., Minneapolis.

Supervisors were honored by awards to Ben Arp and Edwin M. Whipple. Arp is known for directing tunnel building for Utah Construction Co.; Whipple, now retired, directed work for several contractor organizations as well as for the Tennessee Valley Authority.

Included among the jobs he superintended are Pardee Dam, Morris Dam and Chickamauga Dam.

Honored in the engineering category were A. H. Ayers and Otto W. Peterson. Ayers was chief engineer under the late Frank Crowe for the Six Companies on the Hoover Dam construction and, later was chief engineer for Utah Construction Co., and is now in consulting work. Peterson for 30 years was manager of the general construction department of Pacific Gas & Electric Co.

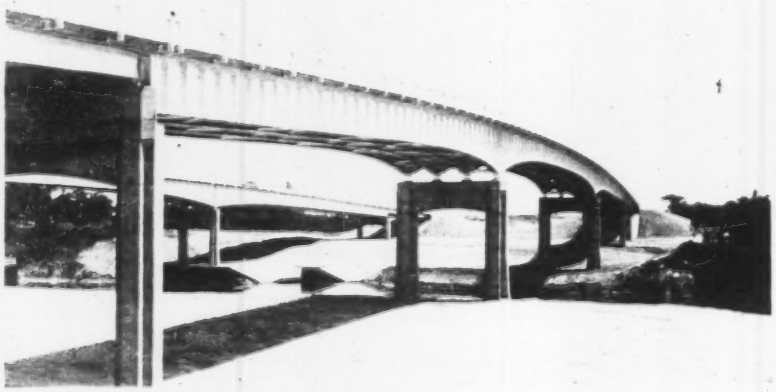
Men doing business with contractors were honored by awards to A. E. Garlinghouse of Garlinghouse Brothers, a Los Angeles construction equipment firm, and A. J. Gock, retired chairman of the board of Bank of America.

FHA Adopts the Standards Of Aluminum-Window Makers

Effective Mar. 1, Federal Housing Administration requirements for aluminum windows will incorporate the specifications of the Aluminum Window Manufacturers Association.

The specifications cover materials, construction, strength of sections, minimum permissible air infiltration and a number of other aspects of window manufacture and installation.

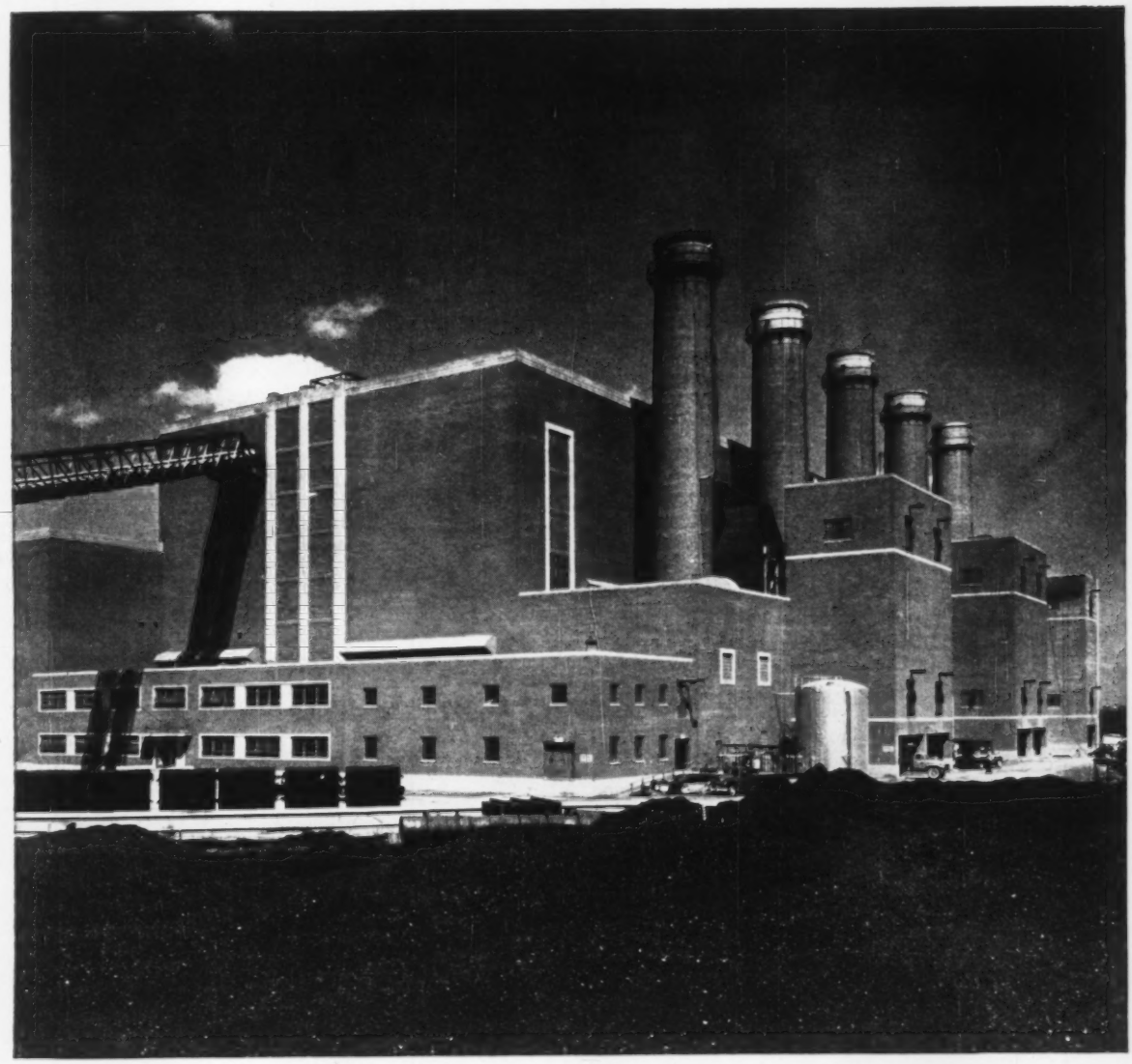
Originally scheduled to take effect last June, the measure was shelved until the later date because of hardship on some manufacturers who had built up inventories earlier.



Texas Takes Welded Girder Span Record

The longest welded girders in the U. S. are now those in the central 270-ft spans of twin bridges across Buffalo Bayou in Houston, Texas. Several months ago, the welded girder record was held by the 234-ft spans of a New York Thruway viaduct at Suffern, N. Y. (ENR Nov. 1, 1956, p. 43). The adjacent anchor arm spans in the Texas bridge are 199 ft, compared to 125 ft. for those in the New York structure.

The general contractor for the Buffalo Bayou bridges, who also erected the girders, was Elmer C. Gardner, Inc., Houston, and the bridges were designed and constructed under supervision of A. C. Kyser, engineer-manager of the Houston Urban Project of the Texas State Highway Department. American Bridge fabricated the girders.



The stacks tell the story

The far stack, newly completed, is the tip-off. It foretells installation of a fifth generating unit at Potomac Electric Power Company's newest and largest plant.

This steam-electric generating station, on the Potomac River just across from Washington, has grown enormously since completion of Unit One in 1949. Another 80,000-kw unit was added in 1950, and 90,000-kw units in 1954 and 1956. When Potomac Electric puts Unit Five into operation, probably in the spring of 1957, the rated capacity of the plant will total 430,000 kw; its effective capability, 493,000 kw.

The steelwork required to support and house these five huge units was fabricated and erected by Bethlehem. In total, 8,400 tons of structural steel and over 300 tons of substation structures were supplied to help fill the growing demand for electric power in and around the nation's capital.

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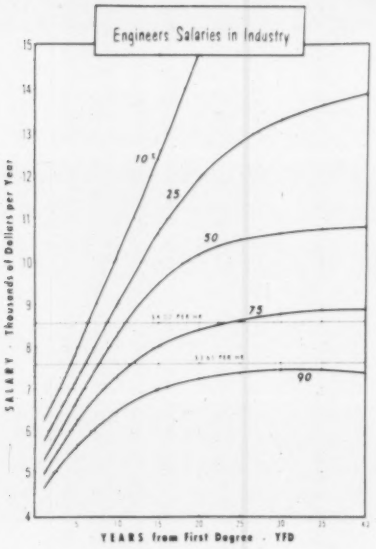
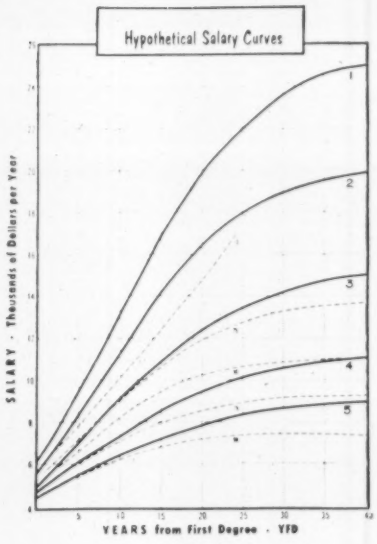
Engineers' salaries

What engineers now make is shown by Graph 1 . . .

What they should be making is shown by Graph 2, under . . .



Graph 1



Graph 2

A System for Salary Administration

Engineers Joint Council, at its general assembly in New York last week, was given the summary findings of its 1956 salary survey and heard a scholarly evaluation of these findings plus a proposal for salary administration.

The EJC salary survey of engineers employed in industry was not yet published last week. But working from its major conclusions, Edward B. Peck, Rutgers professor of engineering, analyzed trends from 1939 to 1956 and proposed a framework of salary administration for engineer employees that would take account of experience, merit and economic trends.

To remedy the lag of engineers' salaries in relation to national productivity, wages and consumer costs, Professor Peck proposes that salary administration recognize and take into account three independent factors:

- The secular trend or general increase that is granted to all without regard to individual experience or merit.
- Experience, to be taken account of throughout the whole career.
- Reestablishment of a merit differential that has real incentive value.

A pattern for pricing different degrees of experience and merit is proposed that reduces to formulas a starting salary policy and provides flexibility for changes due to the secular trend.

• What pay is—What the engineers covered in the report say they are now making is shown in Graph 1. Experience is measured in years from first or bachelor's degree (YFD), and salary is shown in current dollars per year. The curves show the percentile salaries as they vary with experience, with the top line representing the minimum salary of the top 10% of engineers as it varies with experience. Therefore any engineer can spot his 1956 salary on this graph and know roughly what percentile he falls in.

The horizontal lines at $8,500 and $7,600 represent craftsmen's pay. These are typical rates in this area for the building trades—$4.00 and $3.65 per hour for one year at full time and without overtime.

Salary curve for engineers intersects craftsmen's wages at 7.5 and 10 years' experience—in other words, the engineer is 30 years old before he catches up in pay with carpenters and bricklayers, and 32½ before he catches up with plumbers and bricklayers. Integrated over a career of 43 years, the median salary exceeds the carpenters by $80,000, and the plumbers by less than $50,000—not an attractive return on the investment for engineering education, notes Professor Peck.

• What pay could have been—Graph 2 shows what engineers salaries would have been in 1956 if they had been increased by the same factor as wages. Starting salaries would be a little lower than now. However, the median would rise to $16,000 at mid-career compared to about $10,000 now. The curve would end at $20,000 compared to $11,000 now. Bottom curve would end at over $11,000, and the 10th percentile would be $30,000, compared to $15,000 now.

The economic outlook is for a secular growth of about 3% per year. This means that wages should at least double in less than 25 years. This kind of increase is granted without regard for individual merit or productivity—it is strictly a national secular trend. And engineers' salaries should keep up and respond to this secular trend, says Professor Peck. For such national trend increases will exceed the merit and promotional raises of the average engineer.

• What it should be—Presuming that the main purpose of merit and promotional raises is to provide incentive for improved and sustained productivity, these incentives should be provided for the whole career, Professor Peck says.

He proposes that a potential be established for engineers' salaries. This potential will not be static but will change with periodic merit ratings and performance reviews.

Graph 2—What salaries should have been—was obtained by this line of thinking. Professor Peck writes the formula for these curves as follow

$$\frac{ds}{dt} = k\,S\,(A - S)$$ where S is salary

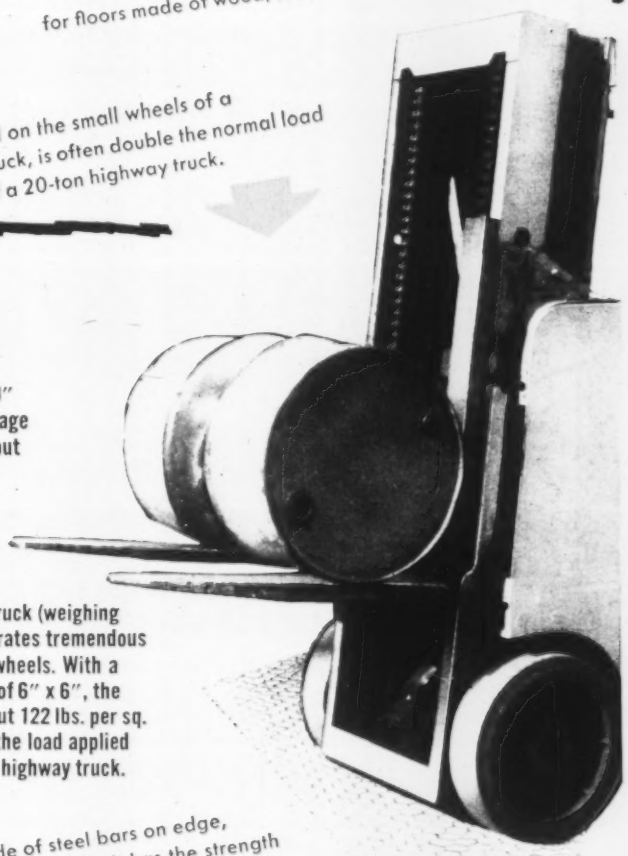
T is experience, or YFD in years, k is a constant computed for each curve from the end conditions, A is potential salary or asympote of each curve. The value A in relation to the final salary at 40 YFD determines the distribution of raises between the first and second half of the career. Experience shows that when A is 3% above the final salary at 40 YFD, there is a good distribution.

Following this system of salary distribution, engineers will again resume the salary scale that their work, education and dedication deserves, concludes Professor Peck.

CAN YOUR FLOOR TAKE TODAY'S HEAVY TRAFFIC?

The wear from heavily loaded industrial trucks and the impact from heavy objects often prove too severe for floors made of wood, asphalt or even concrete.

The concentrated load on the small wheels of a modern fork lift truck, is often double the normal load applied by the wheels of a 20-ton highway truck.



FOR EXAMPLE:

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20"
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A 20-ton highway truck (with a wheel load of 16,000 lbs. on a 14" x 20" contact area) has an average load concentration of about 57 lbs. per square inch.

6" **4400 LBS.**

6"
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Plans Set for Lighted Pike

Plans for the first continuous lighting of a large segment of a major interstate highway were announced last week by Connecticut Highway Commissioner Newman L. Argraves.

At an emergency traffic safety conference held in New York, Argraves said that the 53-mile section of the Connecticut Turnpike between Branford and Greenwich will be completely lighted by mercury luminaires. Standards will be staggered on opposite sides of the pike at 100-ft intervals and the lights will be carried 30 ft above the pavement.

According to another speaker, Edmond C. Powers of the nationally active, Street and Highway Safety Lighting Bureau, Connecticut's plan for continuous lighting represents an important divergence from present highway practice of illuminating only at predetermined hazardous locations. Powers—decrying lack of attention to the problem of highway illumination—blamed inadequate legislation. He commented that only 16 states have any laws at all covering the problem, and that less than 10 of these states have given the question any serious thought. Nowhere in the country, claims Powers, is there an illuminated stretch of state highway even approaching the length of that planned by Connecticut.

Initial installation of the lighting facilities is expected to cost $2.6 million or approximately $48,000 per mile. Operational and maintenance costs will run between $40 and $45 per light—$2,000 to $2,500 per mile, and therefore close to $125,000 per year, for the 53-mile section.

However on the basis of statistics compiled by the National Safety Council, Connecticut feels the expenditure is justified. (NSC reports that while night travel accounts for only 33% of the total vehicular mileage, more than 56% of the 40,000 persons killed in 1956 were victims of after-dark accidents.)

In praising the action of the State of Connecticut, representatives of the Street and Highway Safety Lighting Bureau claimed that adequate lighting of highways would save 10,000 lives annually, prevent injury to 270,000 people, and reduce the annual monetary loss resulting from accidents by as much as $1 billion.

Among the other speakers at the conference were Joseph Barnett, Assistant Deputy Commissioner, Bureau of Public Roads; Lewis W. Prentiss, Executive Vice President, ARBA; and George E. Grotz, Eastern District Representative, National Safety Council.

Competition for Engineers May Boost State Salaries

Faced with keen competition for young engineers graduating from Mountain States universities, Arizona's highway department is attempting to boost the starting salary to $500.

The present departmental starting salary of $430 is believed to be not a sufficient incentive in recruiting for the state's multi-million dollar road program.

Georgia Road Department Gets New Home

The State Highway Department of Georgia has moved into this new $2-million headquarters building, located in the heart of Atlanta. The marble-faced, six-story structure contains 138,000 sq ft of floor space. Contractor was Thompson & Street Construction Co., Charlotte, N. C., the architect was A. Thomas Bradbury of Atlanta.

Near Candlestick Point, outside of San Francisco, a 6-yd. 150-B loads borrow to help build a new freeway.

in California . . . and the World Over

Match big construction jobs with big-production equipment – Bucyrus-Erie Electric Shovels

When construction jobs call for big yardage in extra tough digging, the advantages of a Bucyrus-Erie electric shovel are more valuable than ever. Because these heavy-duty excavators are built to handle even the most demanding jobs, they can be expected to keep dirt-moving costs down in *any* work.

Modern front-end design reduces power-wasting deadweight, yet provides plenty of strength. Heavy-duty construction throughout holds down upkeep, lets you get maximum working time out of every shift. Ward Leonard variable-voltage control provides high speed acceleration and deceleration, assures maximum torque and power when it's needed most.

On future jobs, figure the savings you can expect from Bucyrus-Erie Ward Leonard electric shovels. They are helping make a profit for more and more contractors.

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South Milwaukee, Wisconsin

Announcing the all new 4/10 yard, 8½ ton

85A "QUICK-WAY"...

THE ONE SMALL

When you can make money with a small outfit, think how much more money you can make with the husky *"QUICK-WAY"* 85A. Why be satisfied with a 6 or 7 tons in the 3/8 yard class when you can get 8½ tons in the 4/10 yard *"QUICK-WAY"* 85A—and for approximately the same price.

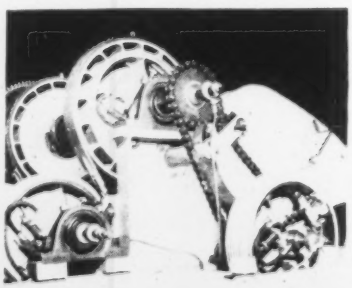
The new *"QUICK-WAY"* 85A has more Big Shovel Features than any other in the small shovel field.

It has been engineered to meet rugged, heavy-duty specifications with fewer moving parts. The power train is oversize, all shafts are splined for easy maintenance. Extra strength has been built in the machinery frame and gantry for greater lifting power.

For the owner, the *"QUICK-WAY"* 85A is a quality machine, designed to deliver more efficient performance per pound and per dollar than many more costly machines.

For the operator, the *"QUICK-WAY"* 85A has been simplified for easy, economical maintenance of all parts. It operates smoothly and quietly for maximum production and minimum operator fatigue.

You owe it to yourself to see the new *"QUICK-WAY"* 85A before you buy any shovel at any price. See your distributor for a demonstration and get the real facts on how you can make more money with the husky *"QUICK-WAY"* 85A.

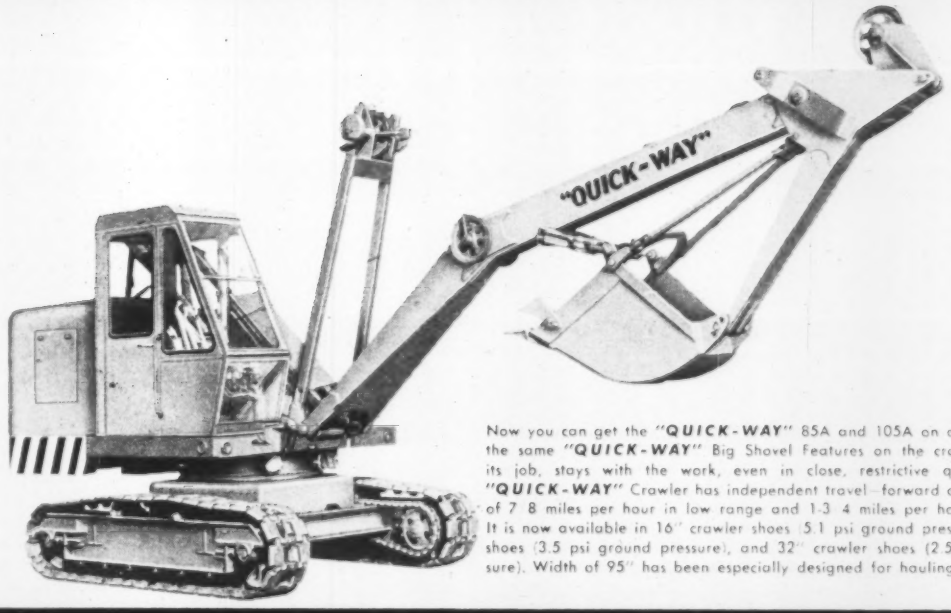


1. **SIMPLIFIED CHAIN AND GEAR DRIVE** for efficient, quiet operation—the combination of roller chains and precision machined gears gives efficient transmission of power through the minimum number of moving parts. This simple, efficient design provides quiet, low-maintenance operation. Stand. engine 47 HP @ 1800 rpm.
2. **MAIN HOIST AND HAUL BACK DRUMS**—are mounted on a single, accessible shaft with sealed anti-friction bearings. Two-piece cast laggings are easily changed for different operations. Large clutch and brake drums have separated surfaces with louvres for cooling.
3. **LARGE SWING DRUMS** are ribbed for cooling—and are mounted on a king-sized horizontal swing shaft. Swing brakes are optional. Vertical swing shaft is mounted in double anti-friction bearings at top with an anti-friction needle roller bearing at bottom. One-piece, bonded brake linings provide more surface for smoother, cooler operation.
4. **OVERSIZE CLUTCHES** have more surface—for smoother, positive action. All clutches are hydraulically operated for easy, sure application of power. Hydraulic clutch controls operate with minimum effort and give the operator the feel of the load at all times.

"QUICK-WAY" ®
A Penn Texas Subsidiary

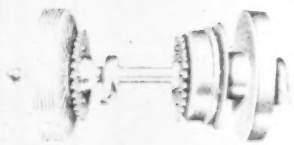
TRUCK SHOVEL CO.
DENVER, COLORADO

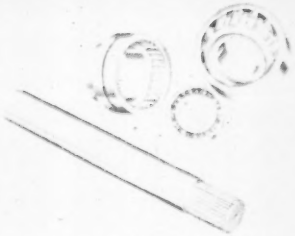
..and the all new "QUICK-WAY" CRAWLERS 85 AC & 105 AC

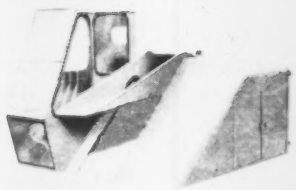


Now you can get the ***"QUICK-WAY"*** 85A and 105A on a crawler! You get the same ***"QUICK-WAY"*** Big Shovel Features on the crawler that gets to its job, stays with the work, even in close, restrictive quarters. The new ***"QUICK-WAY"*** Crawler has independent travel—forward and reverse speeds of 7.8 miles per hour in low range and 1-3.4 miles per hour in high range. It is now available in 16" crawler shoes (5.1 psi ground pressure), 24" crawler shoes (3.5 psi ground pressure), and 32" crawler shoes (2.5 psi ground pressure). Width of 95" has been especially designed for hauling on trailers.

SHOVEL WITH BIG SHOVEL FEATURES







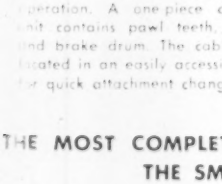
POWER UP AND DOWN BOOM HOIST IS STANDARD—A simple precision design makes safe, sure operation. A one-piece cast steel unit contains pawl, teeth, windlass and brake drum. The cable end is located in an easily accessible place for quick attachment change over.

ONE-PIECE FLOOR FRAME, HEAVY DUTY SWING TABLE GEAR AND HOOK ROLLERS—Floor frame electric welded in jig, then all bearing mounts machined at one time for precision alignment. One-piece, cast steel swing table gear. Four hook rollers distribute load.

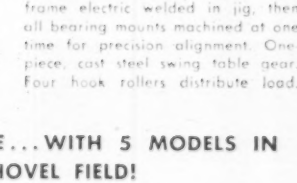
ALL SHAFTS SPLINED, ALL ANTI-FRICTION BEARINGS—All shafts extra large for maximum strength, precision splined for easy maintenance. Anti-friction bearings used on all high-speed, continuous rotating shafts and drums. All shaft bearing surfaces are precision ground.

MACHINERY HOUSING DESIGNED FOR COMPLETE, EASY ACCESS—to all machinery. New feature is an automobile hood-type cable trough cover that lifts high for complete access to central machinery. New cab has 360° vision through removable safety glass windows.

THE MOST COMPLETE LINE...WITH 5 MODELS IN THE SMALL SHOVEL FIELD!

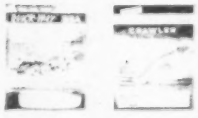


105A & 105AC
5/10 YD., 10½ TONS



125A
6/10 YD., 12½ TONS

with the famous money-making line of "QUICK-WAY" attachments for all models.



Get these important books . . . free!

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- ☐ The new catalog on the *"QUICK-WAY"* 105A and 105AC Crawler.
- ☐ The new catalog on the *"QUICK-WAY"* 125A.

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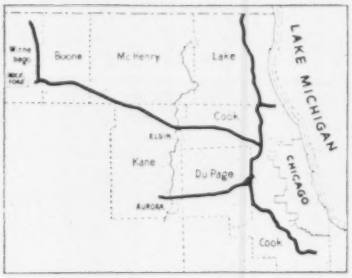
Northern Illinois Toll Highway



Bids to be opened February 14, 1957

CONTRACT E-2A

The work to be done under this Contract shall be commenced on May 15, 1957 or on such earlier date as may be mutually agreed upon between the Commission and the Contractor. All work under this contract shall be completed on or before December 15, 1958 and consists of:

The grading, drainage, paving, the construction of appurtenances, and the erection of precast concrete and structural steel bridges for approximately 7.931 miles of the East-West Route of the Northern Illinois Toll Highway in Construction Section E-2A thereof beginning at a point about 3,000 feet east of SA Route 5 at the Northern Illinois Toll Highway centerline Station 747+40 in Lisle Township, DuPage County, Illinois, and extending easterly to a point approximately 1,150 feet west of Midwest Road at Northern Illinois Toll Highway centerline Station 781+85 in York Township, DuPage County, Illinois.

The approximate quantities of the principal items of work are as follows:

Item	Approximate Quantity
Roadway Excavation, Unclassified	1,468,000 cu. yds.
Borrow	341,000 cu. yds.
Selected Subgrade	475,000 cu. yds.
Granular Subbase	92,000 cu. yds.
10" Reinforced PCC Pavement	274,000 sq. yds.
Bituminous Concrete Shoulders, 3 inch	150,000 sq. yds.
Structural Concrete	7,500 cu. yds.
Reinforcing Steel	1,000,000 lbs.
Structural Steel, Erection	772,000 lbs.

CONTRACT N-3B

The work to be done under this Contract shall be commenced on April 1, 1957 or on such earlier date as may be mutually agreed upon between the Commission and the Contractor. All work under this Contract shall be completed on or before July 31, 1958 and consists of:

The grading, drainage, paving, the construction of appurtenances and the erection of precast concrete bridges for approximately 6.42 miles of the Northern Illinois Toll Highway in Construction Section N-3B thereof, beginning at a point approximately 600 feet east of Town Hall Road at Northern Illinois Toll Highway Centerline Station 611+00 in Flora Township, Boone County, Illinois, and extending easterly to a point approximately 325 feet east of Markley Road at Northern Illinois Toll Highway Centerline 934+00 in Spring Township, Boone County, Illinois.

The approximate quantities of the principal items of work are as follows:

Item	Approximate Quantity
Roadway Excavation, Unclassified	622,000 C.Y.
Borrow	692,000 C.Y.
Selected Subgrade	130,000 C.Y.
Granular Subbase	70,000 C.Y.
10" Reinforced PCC Pavement	199,000 S.Y.
Bituminous Concrete Shoulders	125,000 S.Y.
Structural Concrete	5,600 C.Y.
Reinforcing Steel	855,000 Lbs.

Bids to be opened February 7, 1957

CONTRACT T-7A

Work to be done under this Contract shall be commenced on April 1, 1957, or on such earlier date as may be mutually agreed upon between the Commission and the Contractor. All work under this Contract shall be completed on or before December 15, 1958 and consists of:

Grading, drainage, paving, the construction of appurtenances, and the erection of precast concrete and steel bridges for approximately 4.75 miles of the Tri-State Route of the Northern Illinois Toll Highway in Construction Section T-7A in Cook Co., Ill.

Item	Approximate Quantity
Roadway Excavation	475,000 Cu. Yds.
Borrow	2,200,000 Cu. Yds.
Selected Subgrade	92,000 Cu. Yds.
Granular Subbase	57,000 Cu. Yds.
10" Reinforced PCC Pavement	220,000 Sq. Yds.
3" Bituminous Concrete Shoulders	82,000 Sq. Yds.
Structure Concrete	18,000 Cu. Yds.
Reinforcing Steel	1,500,000 Lbs.
Structural Steel, Erection	2,800,000 Lbs.

THE ILLINOIS STATE TOLL HIGHWAY COMMISSION

By Austin L. Wyman, *Chairman*

Write, wire or phone
for detailed information and necessary forms, Chief Engineer, Room 1654, 20 N. Wacker Dr., Chicago 6, Ill. Telephone Franklin 2-7020.

Previously advertised bids for Contracts T12-A, T12-B, T12-C, T12-ABC, N6A will be opened January 31, 1957.

Water Needs

Ohio conference hears call for bold, expensive action

Maj. Gen. E. C. Itschner, Chief of the Corps of Engineers, and Harry E. Jordan, Executive Secretary of the American Water Works Association, laid out anew their long-range thinking on water resources before a two-day state conference on natural resources in Columbus, Ohio.

General Itschner, just back from a tour of the drought-stricken Southwest with President Eisenhower (see page 43), proposed that future needs of the nation, which he estimated at 453 billion gallons of water daily by 1975, be met through:

- Intensive coordinated planning among all agencies and special interests.
- Preservation of reservoir sites, river bank and floodplain areas, plus control of land uses.
- A thorough exchange of information about contemplated construction and real estate needs on the part of all development groups.
- Legislative action to permit the federal government to incorporate storage in reservoirs to meet future demands for domestic and industrial water, and for increasing low flows.

The Corps' chief criticized cities and industries for growing so closely along the banks of narrow stream channels as to impair their ability to carry flood waters and make the construction of flood protection works prohibitively expansive.

He pointed out that bridge clearances along streams often are inadequate, the railroads and highways along stream banks present grave problems to water conservationists, and that many earlier-built dams are too small to provide the storage capacity for future critical needs.

- **It won't be cheap**—Harry Jordan told the conferees: "No state or city of any importance is going to be able to meet future water needs of its people without a lot of thinking, a lot of planning and a lot of dollar-spending."

He urged municipalities to start planning now for water systems needed decades from now and warned that by 1975 an added 35- to 40-million urban population will be requiring services costing some $7- to $8-billion.

Jordan proposed legislation to facilitate long-distance movement of water. He spelled out the need for water right laws, laws to facilitate construction of storage reservoirs and aqueducts, and laws to permit organization of water and sewage districts or public works districts for water, sewage and waste control.

Note how the uppermost rail has been elliptically rolled. The wide range of wrought iron pipe sizes and forming methods available assures design flexibility.

Durable Wrought Iron bridge railings work easily in the shop—go up fast on the job

Wrought iron bridge railings meet the requirements of the entire roadbuilding team. Here's why.

For engineers and state highway people responsible for safety—as well as reduced costs—railings of wrought iron offer both. Wrought iron's structural strength gives it high impact resistance. And since wrought iron is not affected by attack from concrete, no special coatings are needed. Important too, is wrought iron's resistance to corrosive atmospheric conditions—another essential for long service life.

Fabricators benefit because of wrought iron's excellent working and welding qualities. Wrought iron bends and stretches with less fatigue or stress, and welds are sound and reliable. As a result, wrought iron pipe can be fabricated into easily erected units.

Once installed, wrought iron railings offer clear views through clean lines and simplicity of design. Our booklet, "Wrought Iron in Bridge Construction," contains illustrated case-history reports. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

If your job calls for PIPE PILES

"Faster-from-Foster" service pays off in big savings!

As uses of pipe for piles increase, more and more contractors are calling on L. B. Foster Company for the best and fastest service available. These contractors know us as specialists in steel pipe for piling, in all diameters and wall thicknesses—spiralweld, electricweld, seamless, and lapweld.

On this river-span job we delivered 16-inch diameter Taylor-Forge Spiralweld foundation pipe (in 52 and 60-ft. lengths) as piling for bents of two bridges which span 135-ft. streams. While we are constantly supplying scores of small jobs every day, we'll also deliver all the material required for even the biggest jobs . . . to your job site, and . . . on schedule. No delays for you, no storage problems, more savings.

Send for Foster catalogs—yours for the asking.

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STEEL SHEET PILING · H BEARING PILE · STEEL PIPE · RAILS · ALUMINUM PIPE · ALUMINUM BRIDGE RAILING

Working from barges, Brennan Brothers of La Crosse, Wisconsin and Lansing, Iowa placed spiralweld foundation pipe in 8 feet of water, then had to drive through 40 ft. of Mississippi River sand, clay and mud bottom. Piling supplied by L. B. Foster Co. was concrete capped; each measured 26 x 3 x 2 ft.

Visit Us at the ARBA Convention & Road Show, Booths 59-60

An ENR Report on the $100-Billion Road Program . . .

Not Only Roads But All Construction

When President Eisenhower marshalled federal leadership in favor of a "grand plan for highways", he not only set in motion a $100 billion roadbuilding program for the years between now and 1970, he fashioned a firm foundation for at least a decade of intensive activity in construction of all kinds. For roads, among all the types of civil engineering facilities, are most conducive to ancillary developments.

Roads cause industries to move or expand, new communities to develop, water supply, sanitation and power demands to increase, cities to grow, new natural resources to be exploited. The relatively few modern tollroads and freeways already built have demonstrated this fact beyond question. Multiply their effect fifty to one hundred times, and the widespread importance of the grand highway plan becomes clear—and universally absorbing. A whole nation is on the march.

And so, despite the fact that the "National System of Interstate and Defense Highways", which Congress authorized last July, is focused on roadbuilding, it will affect every member of the construction industry—engineers, no matter what their specialty; contractors, regardless of particular skills; architects, big or small; labor craftsmen of every sort; and materials and machinery producers, without respect to product.

The road program is everybody's program. In truth, it is a total construction program, and infinitely more extensive than the $100 billion label which it carries.

It is for this reason—and a compelling one indeed—that the major portion of this issue is devoted to a thorough study of the road program and the problems which must be faced in carrying it out.

What the Report Covers

- **How basic problems of money, right-of-way and public support are being solved**
- **How the experts look at the question of reimbursement for roads already built**
- **How construction cost trends will affect the highway program**
- **How new design aids can speed progress in the face of a manpower shortage**
- **How modern equipment makes faster road-building possible**
- **How modern construction techniques have been used on roads now under way**
- **How the difficult problem of traffic interchange design is being met**

For the first of the articles—turn the page.

Interstate Highway File:

☑ background

How big is the highway program?

Nearly a third as big as the total military cost of World War II; twice as big as all expenditures on foreign aid since 1945; a third greater than all costs of veterans benefits in 11 years; at least twice the total gross business of the construction industry in any single year. It poses a . . .

Challenge: Spend $100 Billion

ONLY once before in its history—and that occasion was World War II—has the United States contemplated an expenditure for a single purpose of the size it will put forth for the National System of Interstate Highways and its related works.

Yet to a nation enjoying an unparalled prosperity, and in an age where the word "billions" has become a commonplace, the size and scope of the planned highway program has escaped general comprehension.

Indeed, the truly epic proportions of a program, which will see the spending of $100 billion or more over a 13-year period, are only now becoming clear even to the men who are charged with implementing the program. Recent meetings of state and federal highway officials have made it obvious that these men are also a little shocked at the size and complexity of the task with which they are faced.

The legal complications alone are staggering: Some 23 states must seek new legislation in order to conform with requirements of the program; the vast and tangled network of laws governing acquisition of land must be untangled; questions concerning the right to bypass business establishments and whole communities must be settled; methods of apportioning and balancing damages and benefits must be developed, procedures for forbidding a property owner from entering a right-of-way adjoining his land must be worked out—these and many other problems must be solved by the engineers, the lawyers and the courts.

Add to the legal problem the worrisome shortage of engineering personnel, the need for future planning, the vast gaps in knowledge of how best to use the new machines, such as computers, plotters and the like.

Pile on this still other questions concerning labor and how it is to be paid under the federal requirements; of raising the money the states must pay as their share of costs; of determining routes through and around major population centers; of deciding if and by how much designs should exceed minimum standards; of where to put signs and what manner of signs they shall be.

For a frosting, add one further problem: Should states, which have built roads that will meet the new standards, be repaid for their work—and how should that be done, particularly in the case of toll facilities?

And these are still only part of the job ahead.

• **Perspective**—To get a proper view on what's to be done, a number of facts and figures must be kept in mind:

There is now a total of about 3,360,000 miles of highway in the continental United States—including city streets and unsurfaced roads. Federal aid is extended to the states on about 25% of this mileage. Another 20% is directly administered by the states, without federal aid, and the remainder is the responsibility of local governments.

The state-federal aid system comprises two networks of roads: The 234,907-mile primary system, which includes the major highways of the nation; and the 520,371-mile secondary system, comprising farm-to-market, rural mail and school bus routes. On both of these networks, the federal aid for construction amounts to 50%.

The "National System of Interstate and Defense Highways"—basically a part of the primary system—will comprise 41,000 miles of highway, some of it improvement of existing routes, some of it (an estimated two-thirds) on new location. For this system, the federal contribution will amount to 90%.

All of the federally-aided highways are specifically provided for in the legislation (Public Law 627, 84th Congress) approved as the Federal Aid Highway Act of 1956.

• **That $100 billion**—References to the actual expenditure on roads under the new legislation are apt to be confusing, since the figures $27.6 billion, $33 billion, $50 billion, $100 billion have all been used—and correctly, since each covers a part of the program.

on Roads—Wisely

As nearly as can now be determined, however—and without reference to the effect of rising prices—the figure of $100 billion is the estimated total national expenditure by all levels of government over the next 13 years.

It works out this way:

For the interstate system alone, the federal government has authorized $24.8 billion. To match this sum, the states must put up 10% of the cost, or $2.8 billion. Thus the total is the $27.6 billion figure referred to above.

For the primary and secondary systems, Congress appropriated $2.5 billion to cover the next three years. The states must match this figure equally, so that this total will be $5 billion. Add this $5 billion to the $27.6 billion for the interstate system, and you come out with $32.6 billion—the $33 billion figure that has been quoted.

But in fact, Congress has given every indication that it will continue appropriations for the primary and secondary systems on the present $850 million yearly level. Projected for 13 years, that adds to $11 billion—plus $11 billion to be put up by the states gives a total of $22 billion for these two networks.

That adds up to a total program—state and federal—for the interstate, primary and secondary roads, of $49.6 billion—in round numbers the $50 billion figure often used.

In addition, the states and local governments are now spending an average of $4 billion a year for other highway work—exclusive of the federal-aid systems. It is not likely that this figure will be cut greatly. Over 13 years, these expenditures will amount to $52 billion.

Thus the total expenditure on all programs adds up to $101.6 billion—roughly the final figure used.

As a matter of fact, total highway expenditures may be higher than that, since normal maintenance and repair must of course continue. But just how to separate purely maintenance items from other factors such as policing, clearing litter and the like, which are normally lumped as maintenance—and how to offset new construction on old roads against normal maintenance—is a baffling problem.

The significance of all this lies in the manner in which the effects of the federal contribution spread like ripples in a still pond. With a total contribution of perhaps $35.8 billion, work to cost $100 billion or more will be generated.

On some of their roads—for which they had planned to put up 50% of the money—the states now need only 10%. That should free some state funds for matching the federal government on the remaining 50-50 system, and might leave some further funds for application to state roads which do not receive federal aid.

Result is a windfall of some proportions to the states—and a re-examination of many long-term programs. Roads which would not have seen improvement for some years, now may come into current consideration.

• **Money to match**—In part because of this "ripple" effect, the states do not seem to be having too much trouble in finding money to match the federal contributions and to keep their own programs going.

Georgia and Kentucky, for instance, are setting up special appropriations to cover land acquisition costs for their federal aid highways (generally this represents the state's share of the cost of the interstate system), with the knowledge that state funds can be replaced on payment of federal appropriations.

Three of the states—New York, California and Maryland—were forehanded anyway, in setting up revolving funds (in New York and California) or bond funds (Maryland) to cover purchase of right of way. Many other states in the past year took steps to raise revenues—through increases in gasoline taxes and other revenue producing charges. And others are contemplating such rises as new legislative sessions are called this year.

Of course it's not entirely simple. Several of the states—such as Ohio and Texas—where cities and local communities have traditionally acquired land

. . . Spending the $100 billion wisely

C. D. CURTISS (seated), BPR Commissioner, and B. D. Tallamy, Administrator, will direct the national highway effort.

for the state as their share of state highway costs—are involved in lengthy discussions as to just how this burden shall now be carried.

But in general, the problem of finding money doesn't seem to be serious.

• **The right of way**—Ranking with the problem of engineering manpower (discussed in another section of this report) is the question of right of way for the new interstate system, and a number of related problems such as that of limited access.

According to a recent survey conducted by ENGINEERING NEWS-RECORD (ENR Dec. 27, p. 19) 23 states have "quick-take" laws that permit immediate access to property the state wishes to use for road purposes—but the remaining 25 face legal delays ranging from about 30 days to several years before construction forces can move. Several of the states—like Texas—are just now organizing right-of-way departments, having previously depended on local governmental units for land acquisition; others, like Indiana and West Virginia, legally obtain only easements to property they need, despite full payment to the owner.

Only a few are empowered to obtain land for future use; many states specifically may not take any more land than is actually required for right-of-way, even though the land remaining to the property owner is useless because of access or shape and size.

In most states, the problem of assigning damages resulting from highway construction is left largely in the hands of local courts and appraisers—and with it the need for a formula by which any benefits resulting from the road construction can be offset against damages in arriving at a final figure. In some states—like Georgia—this is resolved by declaring that no benefits may be offset against the price to be paid for the land itself, but only against the damages to buildings or structures on the land.

• **Limited access**—The requirements for the 41,000 mile interstate system include that of limited access—the planners wisely refuse to let these new roads become obsolescent because of uncontrolled development on their edges, and have before them the remarkable safety record of the existing limited access tollroads, and freeways.

According to ENR's survey, 33 states have laws on their books giving them the right to control entry or exit to certain roads, and uses of immediately adjoining lands.

But it has recently been brought out that the real meaning of limited access hasn't really been understood by the general public. And as it does become clear, a wave of protest inevitably follows.

The protestors include business establishments, like gasoline and service stations, restaurants, motels and others, which draw the bulk of their trade from passing highway traffic. But they also include landowners who see in the new roads increased sale possibilities for their land; farmers who may see their farms cut in half by a new highway that they cannot cross with their machinery or animals; other businessmen who find that their customers and employees may have to travel extra distances in order to reach their places of business; and of course ordinary citizens who feel that they have the right of access to any public road near their property.

Another group of objectors are the cities and smaller communities themselves—facing the necessity of closing certain streets, of providing other access for their citizens, not to the new road, but to other parts of the community.

• **Public relations**—A good part of the answer—aside from legislation—must be sought in public relations, that is in making the advantages of limited access clear to the public. The highway departments face a tremendous job in this respect, to sell the advantages of safety, overall lower costs for maintenance, lower costs to the motorist because of time savings and thus lessened wear on engines and equipment, and advantages to the local community when the new roads siphon through traffic off local streets.

• **The cities**—Key words in the legislation setting up the interstate system are "to connect . . . major cities and centers of industry. . . ." Thus, the system will be a closed loop—will have no stub ends.

For this reason, parts of the interstate system—eligible for 90% federal aid—that traverse cities, will in most cases represent through routes. In itself, this requirement may go far to solve the choking traffic congestion.

But the problems of the big cities are very special—particularly in the high cost of acquiring land in congested areas, and in construction costs occasioned by the innumerable underground utilities and services which must be maintained. Such roads can cost more than $10 million a mile, altogether—and they can eat up a very large share of a state's total allotment.

The program in the cities has thus far been very slow in getting started—for the reason that the states haven't yet worked out allocations for urban work, and because of the difficulties inherent in any construction work in a major population center.

Facing these problems, and many others, the highway builders have yet a long way to go.

• **Bright spot**—There is no doubt that the contractors can do the work, have the capacity to do much more. And there is no doubt that the manufacturers of machinery can produce the estimated $3 billion worth of machines which will be needed.

There's no shortage of labor in sight, though there might be spots of trou-

. . . Here's What the States Will Have

ble for contracts in sparsely-settled areas.

For the moment, there seems to be no doubt about materials—barring possible local spot shortages.

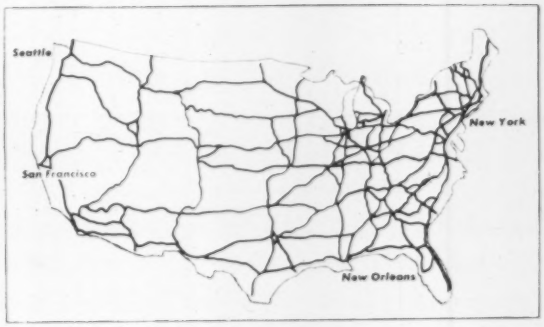
• **A long haul**—As of this moment, the program isn't nearly in full stride. According to the Bureau of Public Roads, the rate of contract letting is now about $20 million weekly, on a national basis. To meet the roughly $2 billion a year that Congress has called for, that rate must be doubled.

Doubling it will call for tremendous effort on the part of the administrators, because it is an obvious fact that most of the present contracts represent work planned several years ago in anticipation of the expanded program.

Finally, before new contracts are let, all the other problems—notably finding the money, obtaining the right-of-way, and solving the limited access problem—must be worked out.

Interstate System

Designed both for commerce and defense, the 41,000-mile interstate highway network blankets the whole country. →



How Much and Where

Based on Bureau of Public Roads figures, here are mileages on the various systems, and federal funds allocated for construction. ↓

State	Mileage, Designated Interstate System			Mileage, Primary System			Mileage, Secondary System	Money for Interstate System to 1959 (Millions)		Money for Primary and Secondary Systems to 1959, States Match Equally (Millions)
	Rural	Urban	Total	Rural	Urban	Total		Federal	State	
Alabama	822	125	947	1,572	388	5,260	13,930	98.9	13.0	37.0
Arizona	1,132	55	1,187	2,556	71	2,627	5,997	55.9	7.3	22.2
Arkansas	182	65	247	3,328	186	3,569	13,636	70.8	9.4	27.5
California	1,791	365	2,156	6,073	1,808	7,881	16,254	277.8	36.3	99.5
Colorado	615	63	678	3,912	128	4,040	5,802	66.5	8.6	26.2
Connecticut	158	120	278	806	297	1,103	1,242	47.0	6.2	17.3
D. C.		28	28		128	128	80	30.5	4.0	11.1
Delaware	38	3	41	991	44	535	1,421	30.3	3.9	8.00
Florida	1,008	165	1,173	3,893	443	4,336	10,715	82.8	10.8	30.5
Georgia	1,051	120	1,171	7,213	391	7,604	13,041	113.6	15.2	42.6
Idaho	637	22	659	3,441	22	3,306	1,518	19.2	6.4	18.2
Illinois	1,351	311	1,662	9,358	1,173	10,531	16,784	229.7	30.0	82.6
Indiana	901	211	1,112	3,264	526	3,790	15,822	118.5	6.6	41.2
Iowa	670	66	736	9,284	437	9,721	31,114	99.4	13.0	40.0
Kansas	702	69	771	7,274	325	7,601	22,527	88.5	11.7	37.7
Kentucky	590	78	668	3,630	236	3,866	15,203	91.4	11.9	33.1
Louisiana	545	112	657	2,467	255	2,722	5,815	80.4	10.6	29.1
Maine	277	36	313	1,519	99	1,618	2,271	39.2	5.1	13.8
Maryland	234	121	355	1,714	284	1,998	3,978	58.4	7.5	20.0
Massachusetts	217	198	415	1,309	763	2,072	2,197	101.0	13.8	34.1
Michigan	895	203	1,098	6,104	517	6,621	21,101	175.2	23.0	63.7
Minnesota	780	136	916	7,140	574	7,714	19,622	109.9	14.3	44.0
Mississippi	611	80	691	4,574	230	5,104	9,492	77.4	10.1	29.4
Missouri	1,062	97	1,159	7,981	268	8,249	18,896	132.0	17.3	51.5
Montana	1,210	29	1,239	5,431	92	5,943	4,310	69.9	9.1	26.4
Nebraska	473	28	501	5,090	130	5,230	12,840	69.8	9.1	30.8
Nevada	529	11	540	2,169	28	2,197	2,442	50.9	6.7	17.9
New Hampshire	183	31	214	1,084	116	1,200	1,540	30.5	4.0	8.4
New Jersey	286	168	454	1,166	632	1,798	1,065	106.7	14.0	35.3
New Mexico	968	45	1,013	3,765	114	3,929	5,231	58.7	7.8	23.8
New York	737	185	1,232	8,758	2,003	10,761	19,311	315.4	35.4	118.1
North Carolina	627	87	714	6,555	409	6,964	23,897	124.2	16.3	44.5
North Dakota	196	21	317	3,188	58	3,246	12,730	54.0	7.2	21.2
Ohio	1,098	255	1,353	6,631	993	7,624	16,961	208.6	27.7	71.0
Oklahoma	747	88	835	7,150	250	7,400	11,629	87.2	11.6	35.2
Oregon	684	73	757	3,747	179	3,926	5,382	66.2	8.6	27.4
Pennsylvania	1,126	352	1,478	5,996	1,114	7,110	13,254	261.1	34.4	89.4
Rhode Island	21	47	68	250	220	470	329	30.5	4.0	10.3
South Carolina	714	55	769	4,396	265	4,781	12,541	65.5	8.5	23.5
South Dakota	512	19	531	4,426	78	4,504	12,392	56.5	7.4	22.2
Tennessee	1,002	91	1,093	4,957	283	5,240	9,517	104.3	13.8	38.8
Texas	2,569	343	2,912	15,041	1,062	16,103	27,834	280.9	37.0	111.7
Utah	630	57	716	2,082	107	2,189	3,248	47.5	6.2	17.6
Vermont	309	35	344	1,185	65	1,250	1,782	30.5	4.0	7.6
Virginia	875	133	1,008	4,273	387	4,660	17,913	98.6	12.9	35.7
Washington	511	121	632	3,361	270	3,631	9,500	78.3	10.4	30.0
West Virginia	183	43	226	2,196	190	2,386	11,038	18.1	7.7	20.1
Wisconsin	427	55	482	5,554	444	5,997	18,558	110.9	14.5	42.2
Wyoming	991	28	1,019	3,389	43	3,432	2,117	50.6	6.4	17.9

Interstate Highway File:

- [x] Prospects and Problems
- [ ] Design
- [ ] Construction
- [ ] Costs

Congress Wants to Know . . .

REIMBURSEMENT:

ENR asked these men . . .

D. C. Greer
"A crippling practice"

B. H. Petty
"Seems justified"

J. Steelman
"It can be worked out"

W. Owen
"Highly questionable"

When Congress passed the Federal Aid Highway Act of 1956 it reserved for future study and report by January, 1958: the question of whether the federal government should, in effect, "buy into" existing roads on the 41,000-mile interstate system—in addition to assuming 90% of the cost of system routes yet to be built. Such payments were referred to as "reimbursements" on the ground that some states—and tollroad authorities—had used their own money to build roads that the government would otherwise have paid for had they been deferred to 1957.

The reimbursement idea originated in the 1954 studies of the "grand plan" for highways by President Eisenhower's Clay Committee. It was given substance by inclusion in the highway bill considered and rejected by Congress in 1955.

That bill proposed to credit the states the difference between original cost and depreciated cost of a road, less 10% of the depreciated cost and less any federal aid funds used in its construction. It also proposed that states should be credited for the depreciated construction costs of toll highways, also less 10%.

The credits in either case could be applied to the construction of projects on the federal aid primary system or, in the case of tollroad credits, could be used to retire any bonds which were then outstanding.

Reimbursement credits are claimed by some to be justified on the assumption that federal interstate system policy is based on a 90% federal investment in the entire 41,000-mile system. They also justify reimbursement as a means of being fair to states who used their own money instead of federal funds to finance their roads.

These arguments are not, however, universally accepted. Opponents point out that the $25 billion of federal funds included in the 1956 Highway Act are earmarked for "completion" of the interstate system, not for federal investment in mileage already in service. They also argue that no practicable or fair reimbursement formula can be devised. And, finally, they contend that states progressive enough to build their own modern highways have been compensated by the earlier use of these facilities and by the income which they have generated.

To reimburse or not is a billion dollar question, for the tollroads alone cost twice that figure, to say nothing of the toll-free roads that meet interstate system standards. The right answer to the question is therefore vital to the great highway development program to which the nation has committed itself. Congress wants the right answer. In presenting the differing views of notable highway authorities in this article, they and we hope that thinking on the reimbursement question may be stimulated to the degree necessary to dispose of it in the national interest.

DeWitt C. Greer

NO . . . need money for new roads

The Federal Aid Highway Act of 1956 established a key system of 41,000 miles of important highways in this country, ordered that this system be completed to adequate standards of construction within a specified period of time, and went further to establish the funds to pay the cost of attaining this objective. This is the first time in the history of highway development in this country that a specific target date has been established on a definite system of roads. This pattern is so outstanding in merit that nothing should be done either to detract or to upset this schedule of highway construction.

The needs of the various highway systems in the United States are so great and the available funds so inadequate that we must not now start paying off past obligations, but must keep our eye trained on more and better roads for the future.

Even if we were to grant the merit of reimbursement to the states for free road construction on the interstate system or to tollroad authorities for their

Charles E. DeLeuw; Consulting Engineer — Chicago
Dewitt C. Greer; Texas State Highway Engineer — Austin, Texas
Roy E. Jorgensen; Engineering Counsel, Nat'l Highway Users Conf., Inc. Wash. D.C.
G. Donald Kennedy; President, Portland Cement Association, Chicago
Gale Moss; General Manager Kansas Turnpike Authority
Enoch R. Needles; Consulting Engineer — New York
Wilfred Owen; The Brookings Institution — Washington, D.C.
Ben H. Petty; Professor, Highway Engineering Purdue University
Norman M. Pritchett; Chief Engineer — Maryland State Roads Commission
Julien R. Steelman; President, Koehring Co Milwaukee, Wisc.
Lawrence S. Waterbury; Consulting Engineer New York
Richard M. Zettel; Institute of Transportation University of California

Should the federal government reimburse states and toll authorities for roads on the interstate system already built to required standards? Here are some thoughtful answers by highway leaders on . . .

A Billion Dollar Question

C. E. DeLeuw
"Difficult but possible"

K. M. Zettel
"Accomplish nothing"

G. D. Kennedy
"States should get credit"

E. R. Needles
"New highways only"

G. Moss
"Seems logical"

L. S. Waterbury
"With mile-for-mile credits"

N. M. Pritchett
"The justice is indisputable"

R. E. Jorgensen
"Table the question until later"

construction on the interstate system, the problem is so complex and the principle of paying back past expenditures is so far-reaching that a practice of reimbursement would unquestionably cripple and handicap the accomplishment of the objective of an adequate system of public highways for this and future generations.

Ben H. Petty

YES . . . states with existing high standard roads are states with heavy traffic, which need federal aid the most

This question poses one of the most difficult problems facing the administrators of the 1956 Highway Act. Near-equal groups will be dissatisfied regardless of which way the decision goes.

The states should be reimbursed for actual costs of construction work providing that only the work meeting the new interstate highway system standards shall be reimbursable. This should include tollroads on the interstate system, if they meet interstate standards. In the case of tollroads, it is questionable if financing costs should be reimbursed, and certainly costs of toll collection booths and similar facilities, not required on interstate highways, should be excluded. Only 90% of actual costs should be reimbursable.

This would permit the retirement of all or a major share of the outstanding bonds (legal status of the bond issue permitting), and these roads should become free roads just as soon as that is done.

States, which have been aggressive and willing to raise money for construction on this system meeting interstate standards, should not be penalized by other states, which have dragged their feet. In general, states, that have moved ahead on this advanced type of highway facility, are the "heavy traffic" states, and will have many needs to serve on other sections of their federal aid systems from these reimbursed funds.

True, those who base their arguments on the goal of a *completed* interstate system, and think funds should be distributed on the basis of "needs," have a reasonable case. But if we look at the problem of "traffic needs", then the heavy traffic states and metropolitan areas have the best of the argument.

For years, a considerable proportion of federal aid funds raised in several states has been diverted to so-called poorer states for highway construction. Indiana loses about one-third of its federal fuel tax collected. In some states, the percentage is much higher. Apparently this procedure will continue under the new federal aid act.

Since the government will be paying 90% of construction costs on the interstate system, the scramble for funds will be terrific. From a political standpoint, it may be difficult to handle this program other than on the basis of needs. But from the standpoint of traffic and safety needs, reimbursement seems justified.

Julien R. Steelman

YES . . . equity to states who have built tollroads requires reimbursement

The question of policy on the integration of existing tollroads with the interstate system is as much one of equity as it is of finance. Its significance has been heightened by the fact that final passage of the 1956 Highway Act was preceded by an unsuccessful attempt to pass a somewhat similar bill the previous year. During the intervening period some states undoubtedly "treaded water" on development of their interstate routes, and some tollroad projects were put in suspension pending the outcome of the 1956 Act. In other areas work on interstate routes was out on schedule, and tollroad projects were car-

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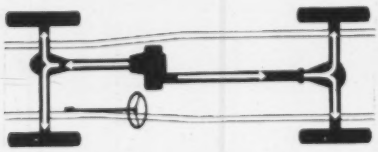

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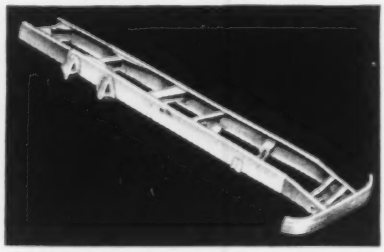

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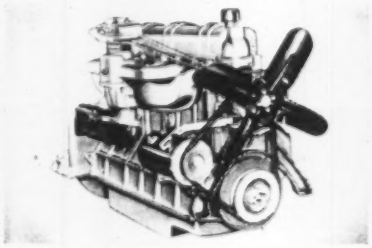
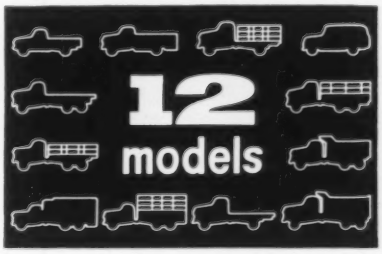
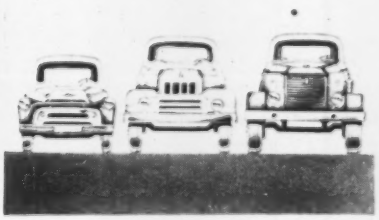


7 **Dependable, economical power** with sixteen 6-cylinder engines, up to 212 hp. Heat-treated, forged steel crankshafts and big bearing areas for a longer, more useful life. Precision machined, quiet, long lasting timing gears, too.



8 **Save time and money.** Get the truck that matches your job *exactly*. No need to compromise with the great span of 12 factory-built INTERNATIONAL 4x4 and 6x6 models, 7,000 to 43,000 lbs. GVW. Choice of job-matched components.



9 **World's most complete line.** There is an INTERNATIONAL "tailor-made" for every truck job, ½ tonners to 90,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own.

ned on without waiting the outcome of highway legislation with its probable change in ratio of federal to state financing.

It seems clear that some policy of retroactive credit must be given to those states that have proceeded with interstate system improvement either as a direct project or through the medium of tollroad authorities. It also seems necessary to put all roads falling in the area of the interstate system on the same status, which would mean taking over most existing tollroads.

One logical way to do this would be to set up a depreciation formula with proper provision for maintenance and repair, and thus arrive at a true value for each existing tollroad or state road meeting interstate standards. This value should then be credited to the states on the ratio spelled out in the present act. This credit could be used as a basis for paying off existing bonds where desirable, or applied to additional roads where legal conditions and the economies made it desirable and possible for the state to take over tollroad authority obligations.

The integration of existing tollroads into the interstate system is bound to involve at least some minor inequities. Not to integrate them will, I feel, involve greater inequities. I feel sure that it can be worked out with the cooperation and good intentions of the different interests involved.

Wilfred Owen

NO . . . intent is to complete interstate system, not to reshuffle methods of payment on existing roads

In the Federal Aid Highway Act of 1956, the intent of Congress has been set forth clearly: "It is hereby declared to be essential to the national interest to provide for the early completion of the national system of interstate highways . . ."

The use of federal funds to compensate states for free roads already built on the system, or to free toll sections of the interstate system already constructed to approved standards, would defeat this purpose. The result would not further the task of building the new roads we need, but would merely alter the methods used to get the roads we already have. Our objective is to move forward to get the system built, not to concern ourselves with what has already been accomplished toward achieving that objective.

The principal problem relates to tollroads since they represent the greatest mileage of highways meeting interstate highway standards. To use federal funds to eliminate tolls would be highly questionable public policy. For despite the unprecedented rate of federal expenditure now made possible for the interstate system, total highway needs in the United States still exceed available revenues by a wide margin. On the interstate system itself it is highly probable that cost estimates for urban sections are low—that substantially more than $27 billion may be required to get the system built. For the entire road and street system, total needs over a 50-year period will be no less than $207 billion—far more money than is now in sight.

The accelerated federal highway program, then, will not pay the total highway bill. It has been a big step forward, but only one of many steps that will have to be taken to assure the tremendous outlays that will be necessary. To use available funds to eliminate tollroads would merely eliminate an important source of revenue that can help overcome the financial difficulties that still remain.

The immediate task is to get under way with a program of highway construction to cope with the extraordinary needs of a rapidly expanding economy. The states that have led the way—either through tollroads or free roads—have reaped the economic rewards of their foresight. They need no compensation. What they do need is to have their neighbors catch up as quickly as possible so that all parts of the country can reap the benefits of a nationwide system of good roads.

Charles E. De Leuw

YES . . . a reimbursement formula would be difficult, but could be worked out

Considered from an abstract viewpoint it appears to be entirely logical that those progressive states and municipal agencies, which have built portions of the interstate highway system from their own funds or by revenue bond turnpike financing, should be compensated in some way for the investments made prior to July 1, 1956. From a practical viewpoint, however, the problem of determining a formula for such compensation is complicated and controversial, and thus difficult of solution.

Considering freeways first, it is probably safe to say that in the normal situation the federal government has contributed 50% of the cost of construction. In other situations, found largely in the urban areas of large metropolitan centers, the federal contribution has been much less; in Chicago, for instance, only one-sixth of the cost.

In considering previous expenditures by individual states, we are inclined to think of a state's funds as those contributed by its taxpayers. As a matter of fact, the source of the funds in most situations is from license fees generally a small portion of the total and motor fuel taxes. In such states as California and Texas, these taxes are paid largely by the states' own taxpayers. In corridor states, however, of which New Jersey is an excellent example, a large portion of the revenues is derived from motor fuel taxes paid by interstate traffic.

Giving weight to all of the factors in the problem, it is my opinion that an equitable base for compensation to the individual states for freeways included in the interstate system would be as follows:

- Establish the present value on the basis of historical cost less accrued depreciation (determined on a sinking fund curve basis) to July 1, 1956.
- Establish the difference between 90% of the present value and the percent of the cost originally contributed by the federal government.
- Credit the states with the difference, and permit the sums so credited to be utilized by the states (and through the states by the counties and cities that participated in the original financing) in meeting their portions of the cost of the additional interstate highway construction prescribed in the 1956 law.

Consider now the situation presented by the incorporation of toll roads in the interstate system. Here, the individual states have made no financial contribution out of funds derived from license fees or motor fuel taxes. The revenues required to meet fixed charges on bond issues are paid entirely by the highway users.

These highway users have, since July 1, 1956, been subjected to double taxation—in addition to all of the state and federal fees and motor fuel taxes, they pay a special impost amounting in the case of passenger automobiles to from one to four cents a mile. Some means should be found for eliminating this double taxation. One solution might be to refund to the individual turnpike authorities the original cost of construction less accrued depreciation; the amount thus paid to be applied either toward the retirement of outstanding revenue bonds, thus advancing the dates for the elimination of tolls, or for the reduction of present toll rates.

It seems to me that the minimum basis for establishing compensation to the individual turnpike authorities should be a refund equivalent to the three cent federal tax on gasoline consumed on the respective tollroads.

These suggestions will eliminate, in my opinion, the inequity in the present law, which most assuredly penalizes those progressive states that already have built upwards of 5,000 miles of the interstate system.

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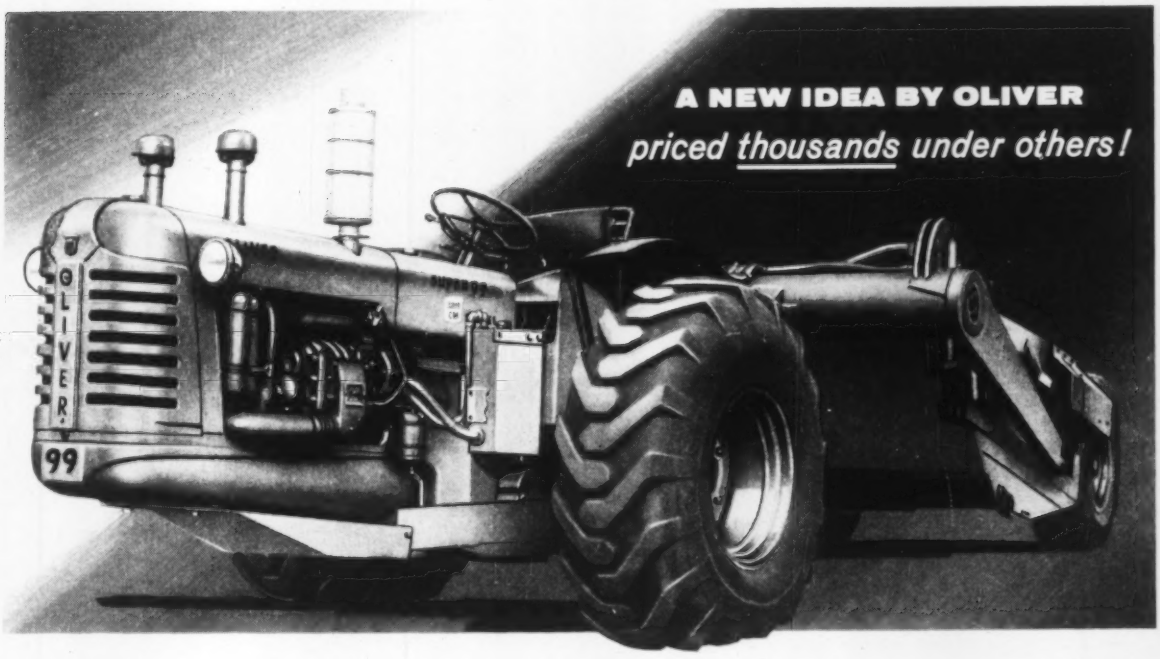

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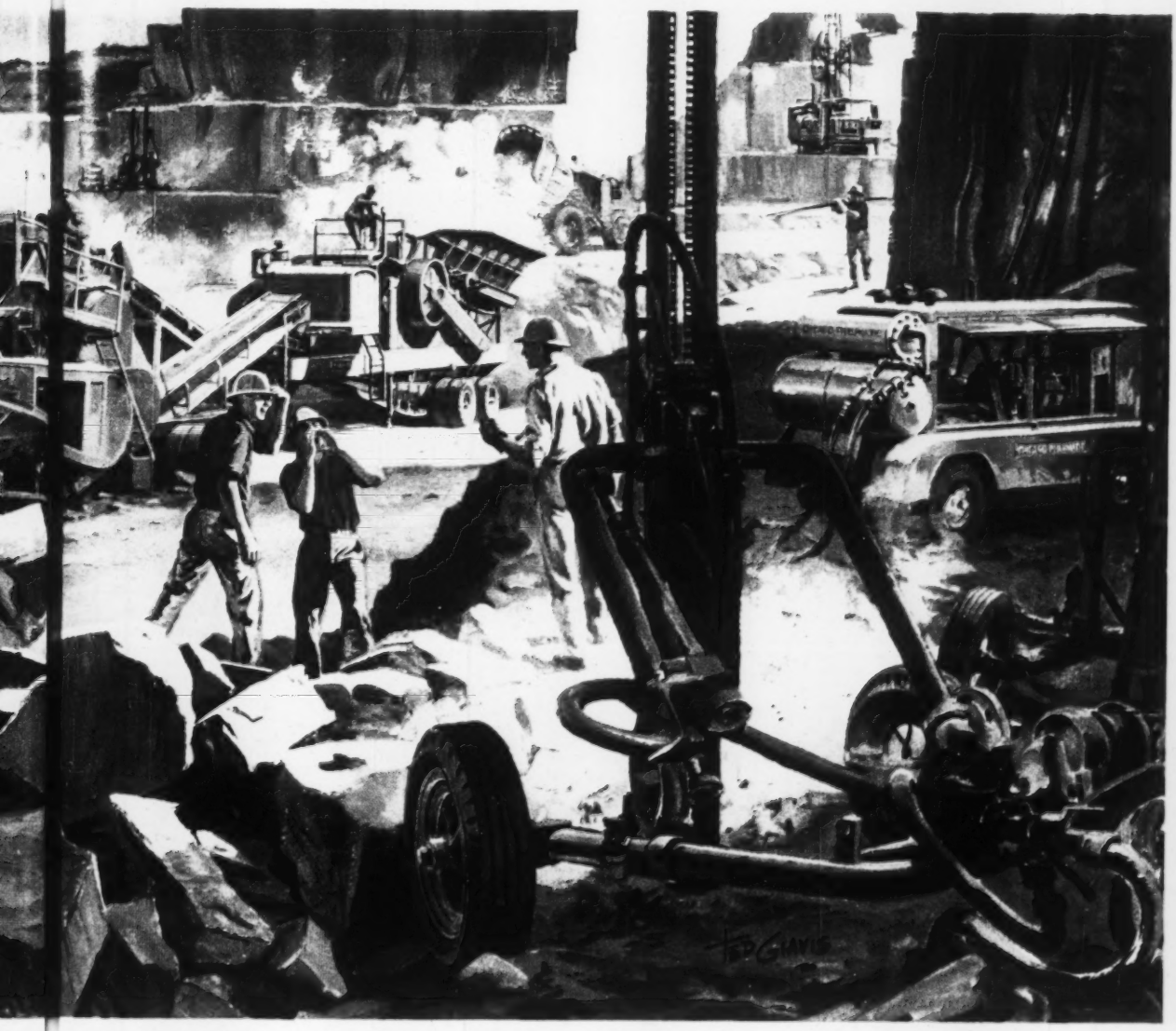

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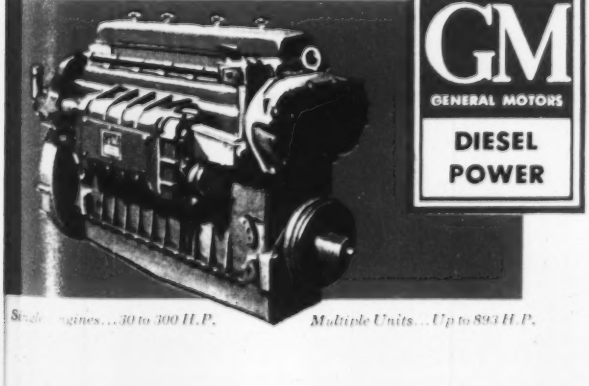

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through the reduction in cost of the total system, and the traveling public would have the use of present tollroads at lower cost, or benefit through advancing the date when tolls would be eliminated.

Richard M. Zettel

NO . . . progressive states with modern roads have enjoyed their benefits

Whenever a new or enlarged grant-in-aid program is started, especially in the public works field, states that have been progressive will incur fiscal penalties as compared with those who have lagged in meeting needs. But it should be recognized that the forward-looking states have enjoyed the benefits of the facilities they have provided. Besides, it is questionable whether any satisfactory method for redress of possible inequities can be devised. This seems especially true in regard to possible reimbursement for interstate highways.

Presumably, reimbursement would be made only for completed highways fully meeting standards of the interstate system. What of the highway that now meets only 95% of the standards because it is being built by stage construction and certain grade separations (for example) will not be needed for some time? What if expensive and fully adequate structures have been built or were in process of building at the cut-off date? What if adequate right-of-way had been acquired at great cost through an advance acquisition program? Many typical examples could be cited casting doubt on the equity of reimbursement for a "completed" highway if none is to be made for a partial but substantial contribution to a segment of the interstate system.

It is assumed here that everyone recognizes the equity of reimbursement for toll-free roads if reimbursement for tollroads is to be made. Would it not also be in order to seek reimbursement for toll bridges and tunnels on the interstate system?

In my view, the case for reimbursement for toll-free roads is more convincing than the case for tollroads—unless the latter can be made free, which I understand would be legally impossible in many cases. In such cases, reimbursement would mean that the highway users of the nation would pay to tollroad states large sums (presumably not to be used on the interstate system) and would continue, directly and indirectly, to pay tolls on their travel and commerce on the interstate system of such states.

Perhaps the most convincing argument against reimbursement for past accomplishments is the cost involved and its effect on the stated intent of Congress that "the interstate system be completed as nearly as practicable over a 13-year period and that the entire system in all the states be brought to simultaneous completion." The new "needs" estimates now being prepared will, I feel sure, reveal higher costs to complete the system than any we have seen so far, because of earlier underestimates in a number of states. Also, highway costs are going up, and are likely to continue rising for some years. If a substantial bill for reimbursement is added to the cost of the program for funds, which will not go to completion of the interstate system, then Congress will have to provide additional financing or face the fact that the system cannot be completed in the time hoped for.

California officials have rejected the notion of seeking reimbursement for the state's completed toll-free expressways and freeways, even though California might receive vast sums in reimbursement. Their thought has been that we should look forward to the task of meeting present and future needs, and not look backward in an attempt to equalize for past efforts. This stand has been widely supported by highway-minded organizations in California.

The issue, as presented here and by the Congress, does not involve reimbursement for any roads started after June 30, 1957. Had the question of prospective reimbursement been raised, the issue would be more difficult, for it would involve the desirability of keeping alive and even stimulating the toll-road movement. As it is, most tollroad development must cease for the immediate future. The liberal federal financing of "free" roads on a needs basis would penalize any state constructing a tollroad as a part of the interstate system, since its "needs" and hence its federal apportionments would be reduced; yet its motorists (and visitors from other states) would pay full federal user taxes and tolls as well. If the question of integrating toll financing with user-charge financing—in order to expedite *future* construction on the interstate system—were at issue, a "reimbursement program might have merit. But nothing would be accomplished toward fulfilling interstate needs—and the cost would be great—by making reimbursement for *past* efforts.

G. Donald Kennedy

YES . . . provide progressive states with additional credit to be applied to other roads

The Highway Act of 1956 declares the intent of Congress to determine whether or not "the federal government should equitably *reimburse* any states for a portion of a highway which is on the interstate system, whether toll or free . . . provided that such highway meets the standards required by this title for the interstate system."

Had this section been worded "Should those states which have built or are building roads on the interstate system to prescribed standards be given *credit for* this advance planning and construction," I think reaction to this section might be quite different.

That, to my mind, is the question posed in Section 114, Title 1. In the last analysis, the Federal Aid Highway Act of 1956 has as its major objective completion of a network of modern, heavy-duty highways within the shortest possible period of time. Congress has stated this intent forcibly in several ways. First, by establishment of a definite length of time for completion of the system. Secondly, by changing the matching formula to 90-10 for this system, indicating federal interest greater than ever before expressed. Third, by providing sufficient federal money to complete the interstate system to the highest standards, for heavy-duty use, including military and defense transportation. This also is the intent expressed by state highway officials in AASHO adoption of design standards for "the type and volume of traffic expected in 1975."

In 1954, in response to a Bureau of Public Roads survey, the states reported that completion of the interstate system would cost $27 billion. But of great importance, they also reported that 5,242 miles of tollroads were in operation, under construction, financed or authorized, which either paralleled or coincided with interstate system routes in 23 states. This excluded mileage planned but not deemed economically feasible.

The point is as clear now as then. Regardless of methods of financing, these tollroads provide or will provide service of the character envisioned by Congress. Some not only coincide with interstate system routes, but meet the standards adopted by the states, and approved by the Bureau of Public Roads. They differ from other interstate system segments only in that federal funds were not available for construction.

States that have anticipated the wishes of Congress and accelerated their heavy-duty highway programs in this fashion should receive some form and proportion of credit for this mileage.

This could be done through federal installments against retirement of bonds, thus removing tolls at once, or through establishment of other appropriate credit to the states as recommended in the 1955 Clay Committee report to the President. Roads built to interstate system standards generate additional and related traffic. After factors of total cost are adjusted against depreciation,

equivalent federal credit could be made available to the states for development of other heavy-duty highways carrying 10,000 or more vehicles per day, to relieve traffic congestion. Both state and national interests would thus be served.

Enoch R. Needles

NO . . . authorized funds are for new highways, and these should be built where they will not damage existing tollroads

It appears quite clear that those states which have undertaken tollroad construction during the past 10 years provided new and important highway facilities at a time when they were virtually unattainable otherwise. A great amount of appreciation is due them. However, to contemplate reimbursement for expenditures made on tollroads injects a point of view with regard to our Federal Highway Act of 1956 that is quite contrary to the basic reasoning behind the legislation.

It seems to me that this act, and the money which becomes available thereunder, relates to construction of NEW highways, and not repayment for highways already in existence. The act was designed primarily to bring about new construction, recognizing that even larger sums of money than those made available would be needed to provide some of the essentials in the building of our greatly needed highway system.

In thinking about the proposed reimbursement, it should be recognized that no state funds of any great consequence entered into the building of these tollroads. Generally, they were built with funds obtained from the sale of revenue bonds, tax exempt to private investors, and without even the pledge of state credit, except in two or three exceptional cases. Where this pledge has been made, generally to secure lower interest costs, there is no expectation that there will be actual demand on the states for interest money. Certainly any demand will be of short duration. Thus it appears that "reimbursement" is the wrong word to use if any large amount of money is to go to those states which have accomplished the construction of tollroads up to this time.

If, on the other hand, federal funds should be paid to those states that have built tollroads, surely the funds should not be used for the purchase and retirement of the outstanding revenue bonds, since the use of money in this way would not produce any new construction. It might be decided to retire these bonds on the theory that all roads should be made free of tolls, but this action would represent a different philosophy from that which is involved in the provision of funds for new highway construction.

Even though there appears to be no reasonable basis on which "reimbursement" could now be made to the states for previous tollroad construction, there is nevertheless a definite obligation upon the federal government to recognize and respect the rights and actions of such states and the rights of the private investors who made the funds available. These obligations of the federal government should be specifically stated in an amendment to the existing act and not be left to definition by agencies or individuals who might be involved.

The act should state specifically that no highway will be built in any manner that will adversely affect the operation of an existing public tollroad. This means that no new road should be built to parallel or compete directly for traffic with an existing tollroad, since clearly every state will have other highways for which greater need will exist and on which the equivalent funds could be more wisely expended. Before a public tollroad is crippled by a competing parallel road free of tolls, the usage of the tollroad should be expanded by removing the tolls from it. Invariably, it will cost less to free the tollroad than to build a new competing or duplicating highway.

The federal government should consciously and definitely plan to make the greatest possible use of our existing tollroad system, since it is for the most part integral with the interstate system. Feeder roads, connecting roads, and roads supplemental to the tollroad system should be built freely and promptly.

The indebtedness on the existing tollroads will be paid off much sooner than we think, probably within the 10 to 15-year period contemplated in the construction program of the 1956 act. We can all look forward to the time when again all of our interstate highways will be free of tolls. Certainly the highway act should be amended to include the present tollroad system as an integral part of the national system.

Gale Moss

YES . . . states which have financed own roads should not be penalized

Trying to approach the question with some degree of realism should not be difficult. Congress has accepted responsibility for financing 90% of the cost of the interstate system. It retains the responsibility of financing 50% of the cost of all other federal systems. To the extent that any toll facility fits into any federal category it would seem logical that reimbursement should be made.

The tollroad revenue bond method has been used largely due to the fact that a facility could be provided "in our time" as against indefinitely waiting for the possibility of constructing the same project with public tax money. Too, it is to be noted that practically all of the major tollroads in the country are on or adjacent to alignments of the interstate system. This is natural since tollroad projects are based on availability of heavy traffic volumes to retire their bonds.

Failure or refusal to reimburse, on some formula, for such projects fitting into or a part of any federal system would seem to me to work a penalty on the states having the foresight and initiative to take on, complete and open projects costing into the billions, which otherwise would ultimately have been done largely at federal expense.

Inasmuch as the federal program contemplates a complete overhaul of the interstate system, and substantial overhauling of the primary and urban systems, it is logical that toll projects on which reimbursements may be contemplated should be considered on a depreciated value, probably as of 1956. Logical also is the fact that if a toll project is obsolete in design or so badly beaten up so as to require the same attention as most of the federal system due for overhaul or new construction, then no reimbursement should be considered.

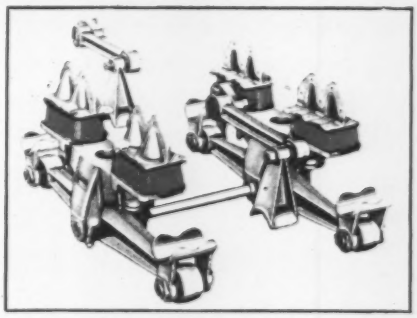
Reimbursement, if made, should be to the state highway department of the state involved and not to a separate toll road authority, if there be one. The highway department then should be permitted to use such funds upon any portion of any federal system. A possible exception would be toll projects that are definitely not on a sound pay-off basis, in which case, perhaps, sufficient reimbursement should be made to retire delinquent bonds or interest. Since the project already will have been built without cost to the federal government, then funds constituting reimbursement to the state for the project should be permitted to be spent without further matching requirements by the state.

Most states will find themselves short of matching funds under the present program. If reimbursement would be made on the premise of the federal government paying for its share of something already constructed, then there is no logical reason why it should again be matched by the state.

Lawrence S. Waterbury

YES . . . but with mile-for-mile credits for tollroads, not with monetary payments

Toll facilities developed by the state should be looked upon as windfalls to the interstate system. Their existence can result in an even greater transcontinental highway network than the 41,000 miles planned. This means the



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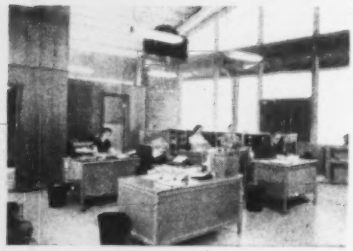

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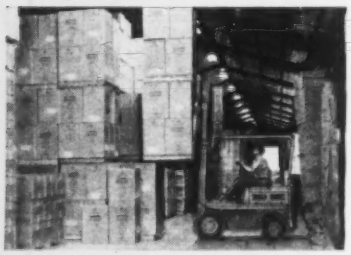

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federal government should repay states for absorbed toll facilities in "kind, not in money."

It means not redeeming outstanding bond issues.

Highways yet to be built under the federal program should not compete with qualified, existing roads, but complement them.

Thus a state might be repaid with feeder and access roads, which will add to the network physically and enhance the use and value of all of the existing systems.

The House Committee on Public Works, which promulgated the new highway construction program, recognized these factors.

Its report accompanying H. R. 10660 last April expressed the intent to "promote maximum integration" of both toll and free roads, and said it did not expect free facilities would be constructed "in direct competition with the toll-roads" included in the interstate system.

Duplication would, of course, be a folly economically and a waste of time. It would saddle some states with a dual system—one toll and one free—which would serve no new purpose.

Additionally, there is a legal and moral obligation involved in the toll facilities, which the nation cannot ignore.

Many persons and institutions invested in revenue-backed bonds, assuming the risk of traffic and earnings. But their covenants are with quasi-public agencies, and they have a right to assume their investments will not be undermined by government.

They performed a useful public service by making money available when no other means was open to financing needed road, bridge and tunnel construction.

True, tollroads are not "free" roads in the accepted sense. But however you finance a road, or a bridge or tunnel, the user has to pay for it. That payment may be either by direct toll or through a tax.

Integrating toll facilities into the interstate system imposes these obligations on Congress: (1) Getting the most mileage out of authorized construction funds; (2) Seeing to it that the states are not penalized for their initiative and foresight in having constructed the facilities; (3) Guarding the rights of bondholders.

The answer to all three is a system of "credits" rather than straight monetary reimbursement for tollroads, bridges and tunnels which would be absorbed into the interstate network.

The credit could be on a mile-for-mile basis. If, for example, a state is eligible for 1,000 miles of federally-aided highways and already has 500 miles of tollroads that meet the requirements of the system, it would still get 1,000 new miles. The 500 miles matching the tollroads would be in the form of feeders and access roads to the system. They would become vital part of the interstate system, adding mileage to it. They would make the tollroads more useful. And they would serve an important economic purpose in helping to develop the regions they traverse.

Section 113 of the 1956 Act provided for incorporating toll facilities into the interstate network, and for constructing approaches to them "even though the project has no use other than as an approach to such tollroad." Also, the act stipulates that affected portions of the tollroad be converted into a free road when its debt shall have been paid off, but this proviso, I think, is broad enough to encourage rather than hinder a plan for road credits.

Norman M. Pritchett

YES . . . otherwise forward-looking highway departments are not only penalized but discouraged

There is a good sprinkling of forward-looking and forward-acting states that realized the important benefits of high-type road improvements. These states embarked on large scale highway construction programs, which have gone far to solve the interstate problems in their part of the nation. Because of the high standards of design, these roads will not require "bedding up" to meet the interstate design standards. They were built in most instances from normal highway incomes, and in many instances from highway bonds for which the states are alone responsible.

Under these conditions the cost of the completed mileage will not be included in the highway needs study required under Section 108, paragraph (d) of the Federal Aid Highway Act of 1956.

Section 114 indicates considerable indefiniteness in the matter of reimbursement by its very wording of "amounts of such reimbursement, if any." This indicates that progressive states run a strong possibility of being severely penalized for having built modern roads on their own initiative.

The justice for reimbursement of free highways financed from regular state revenues is indisputable.

If it is denied, or procrastination causes deferral, then the courageous and forward-looking highway departments are not only penalized but discouraged.

Conversely, the states, which for one reason or another have been unable to improve their interstate systems to acceptable standards, will qualify con-

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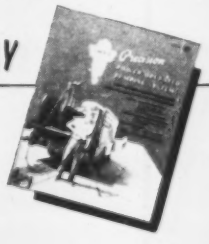

THE MOST TRUSTWORTHY NAME IN LUBRICATING EQUIPMENT

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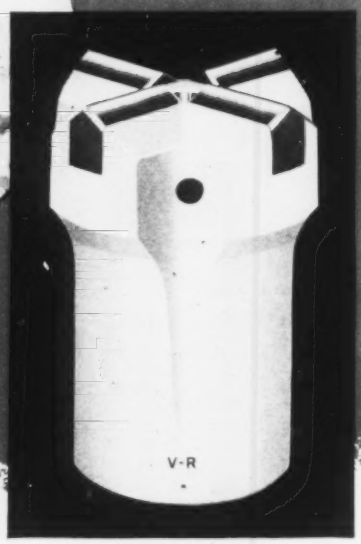
V-R ROCK BITS



. . . their success lies in the exclusive V-R CARBIDE

Make no mistake—rock bit life, drilling speed and cost per foot depend on the *carbide* in a percussion bit.

V-R manufactures its own carbides—makes and controls them from powder to finished product. You are assured of uniform quality, bit after bit.

The carbide grade used in V-R percussion bits is an exclusive grade developed especially for rock drilling . . . Compare its impact and abrasion resistance with any other—you'll find you can drill more on any job with V-R bits.

Bottoming type bits—pioneered by V-R for bottoming drive rods. 19 sizes $1^{9}/_{16}$" through 5". Thread types 200, 400, 600, 700, 1000 and Type 2. Available in cross or "X" styles.

Shoulder type bits—14 standard sizes $1^{3}/_{8}$" through 3". Any type thread.

Push-on bits—for new or reconditioned steels. 11 sizes $1^{1}/_{4}$" through $1^{7}/_{8}$".

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During the Road Show
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Manufacturers of Cemented Carbides . . . Rock and Mining Bits

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

852 Market Street • Waukegan, Illinois

pletely for economics.

It is to be hoped that Congress will take full into consideration the objective of the Federal Aid Highway Act of 1956. That objective is to provide fully integrated system of highways within the next 13 years, and make reasonable reimbursement to the states for those sections of highways which have been completed to such high standards and placed in the interstate system as part of the complete network.

Roy E. Jorgensen

NO . . . table reimbursement question for eight to ten years until construction is further along

If there is to be reimbursement, it should be deferred until such time as the entire interstate system approaches completion to the standards that have been established.

Some states already have indicated that reappraisals show their original cost estimates were low.

In light of this, it would seem to be essential that all available funds be devoted to the construction of new facilities, and not be diverted to the reimbursement for facilities already completed.

If and when reimbursement is provided it should incorporate a requirement for "freeing" those facilities on which tolls are collected. Otherwise, the highway users who, through the federal government, will have made a major contribution for specific highways will find that they are again charged for the same facilities through tolls.

If reimbursement is provided it is not believed completion prior to August 2, 1947, should prevent reimbursement, as now written into Section 114 of the Federal-Aid Highway Act of 1956.

It seems to me the proper criterion is the adequacy of the facility to meet the standards of the interstate system as laid down for tollroads, bridges and tunnels, in Section 115 of the act.

In other words, why should there be reimbursement for tollroads incorporated into the system and constructed after August 2, 1947, but no reimbursement for those incorporated into the system but constructed before that date?

In summary, my feeling is that it would be desirable to have determination of a policy for reimbursement deferred until the program has progressed for a number of years—say, eight or ten.

It should then be possible to establish a policy that would deal fairly with all interests and, at the same time, not jeopardize the rapid modernization of the entire system.

like no other building device

Spanall®

HORIZONTAL SHORING

helps contractors save time, labor and money

S-L Spanall assembles fast and conveniently to desired span lengths—without need for intermediate supports

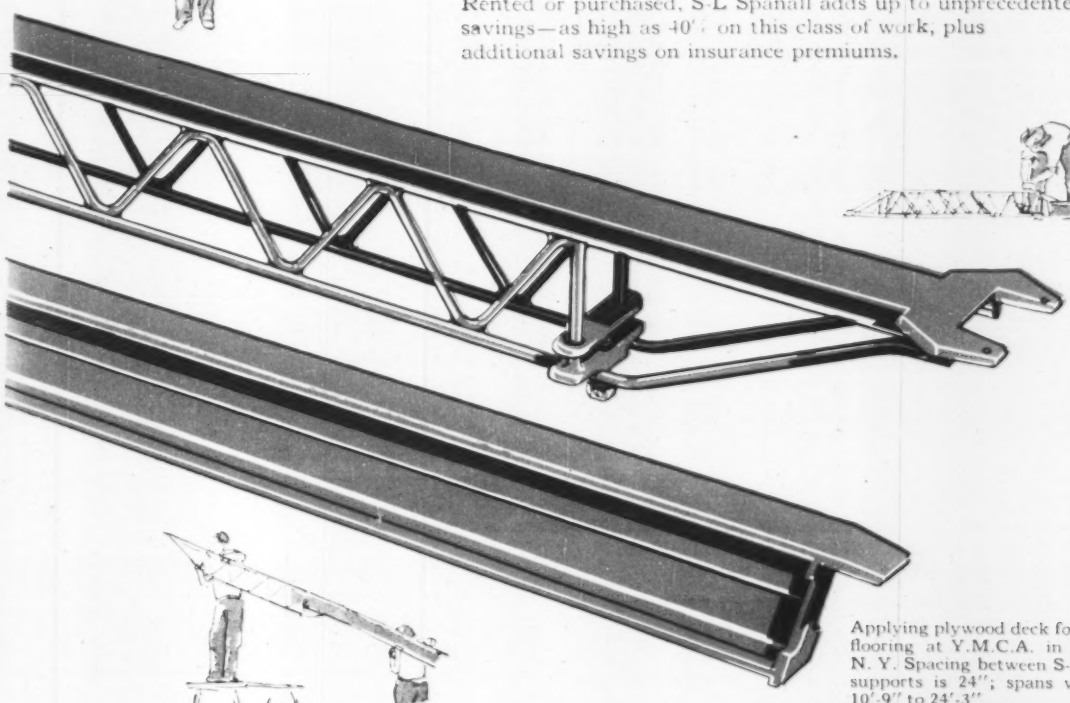
—frees work areas on floor below

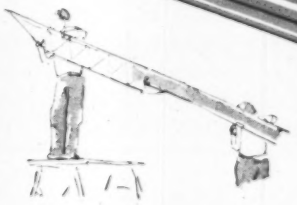
—adjusts quickly to desired span lengths

—supports 44 times its own weight—with safety factor of 2.17

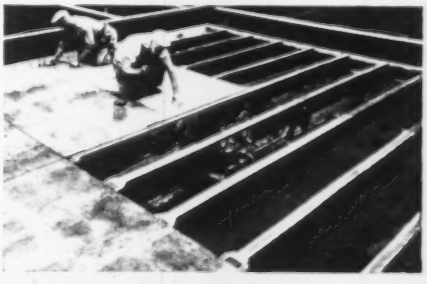
—*and* **Spanall** *features built-in camber,* easy to set and automatically correct for any span length.

Rented or purchased, S-L Spanall adds up to unprecedented savings—as high as 40% on this class of work, plus additional savings on insurance premiums.





Applying plywood deck for concrete flooring at Y.M.C.A. in Syracuse, N. Y. Spacing between S-L Spanall supports is 24"; spans vary from 10'-9" to 24'-3"



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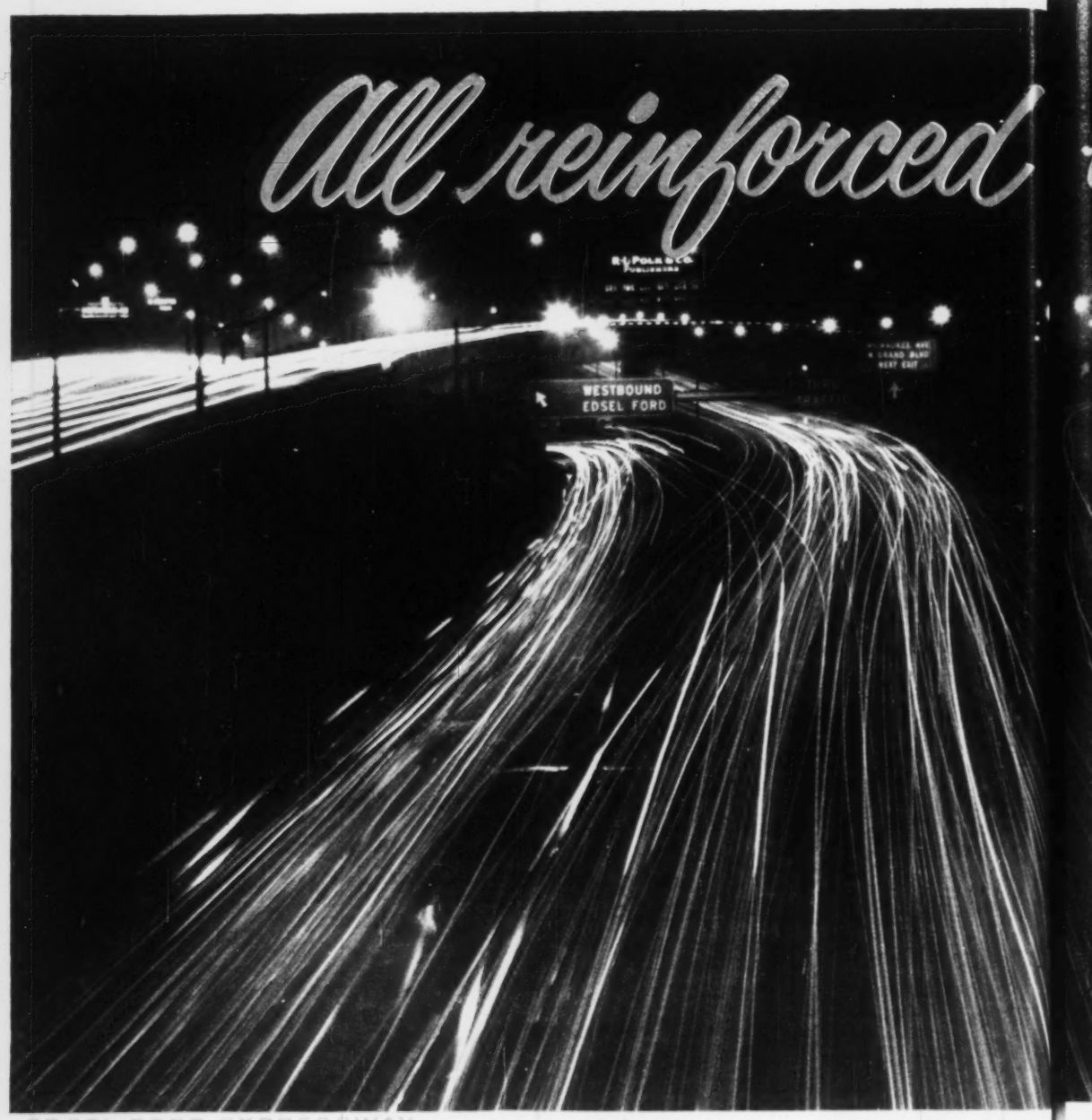

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PENNSYLVANIA TURNPIKE

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...with AMERICAN WELDED WIRE FABRIC

EASY TO INSTALL. American Welded Wire Fabric comes in prefabricated sheets that can be placed quickly with minimum crews. It stays in place during pouring.

LOW COST. American Welded Wire Fabric has high-strength steel wire, electrically welded together for positive anchorage. The concrete slab is effectively reinforced with less steel than other types of reinforcement; so you have less steel to buy and less to handle. American Welded Wire Fabric keeps down maintenance costs, too, because it prevents destructive cracking, keeps roads smooth and safe.

VERSATILE. American Welded Wire Fabric comes in wide sheets for continuously reinforced concrete pavements in wire sizes up to and including ½" in diameter, at 2", 3", 4", and 6" on centers. The use of American Welded Wire Fabric increases the strength of the concrete slab by 30% over that of non-reinforced concrete.

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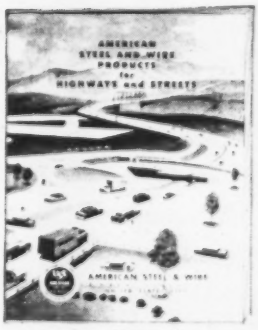
Every type of reinforced concrete construction needs

USS American Welded Wire Fabric

UNITED STATES STEEL USS

FREE CATALOG



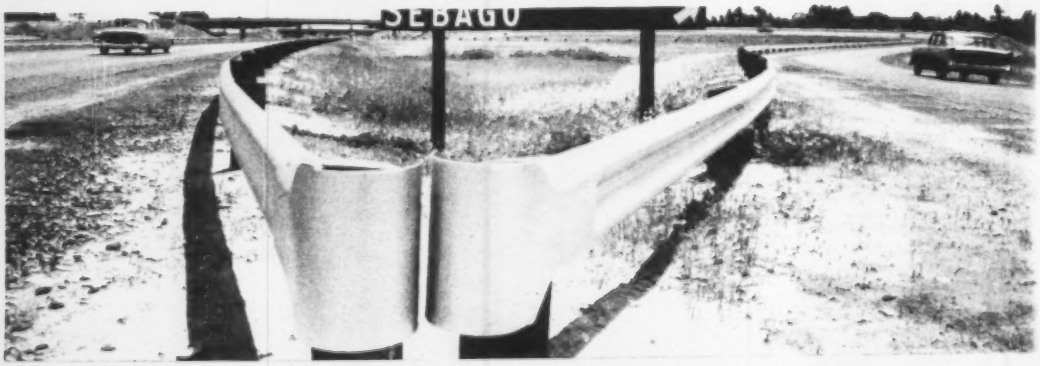
American Products for Highways and Streets

Here's a brand-new catalog describing the entire American line of products for highway and street construction. Includes application photographs and helpful information about each of these products. Send for your copy of this informative catalog today. Use the check box coupon at the end of this 8 page unit. It's free!

On New Maine Turnpike

Two types of

COMBINE SAFETY WITH



American Highway Guard

GOOD APPEARANCE

A American Multisafty Cable Highway Guard, like this used on the new Maine Turnpike, provides two-fold protection. First, it restrains cars from plummeting off the berm. Second, the combination of resilient steel cable and resilient spring-steel offset brackets cushions the shock of collision and helps minimize damage to the vehicle, serious injury to the passengers.

American Beam-Type Highway Guard is also used on parts of the Maine Turnpike. It provides a strong, attractive, durable guard.

THE MEN who designed the Maine Turnpike needed two types of highway guard. Along some sections they wanted to use cable guard; at other sections, they wanted beam-type guard. They obtained *both* types from American Steel & Wire. American Multisafty Highway Cable Guard and American Beam-type Highway Guard assure an economical installation that will stay attractive *and* protective with minimum maintenance. With these two guards they combined essential safety with desirable good looks.

American Multisafty Cable Guard comes in two basic types: 3-cable guard, which gives adequate protection at highway speeds up to about 50 miles per hour; and 4-cable highway guard, which protects up to about 75 miles per hour. A Super Guard consists of six or eight cables for special situations, where an extraordinary margin of safety is desired. In any installation, cables can be added or replaced quickly and easily if changing highway conditions demand additional protection.

Remember the quality and the reputation of American Steel & Wire when you need construction materials of any type of highway guard, wire fabric, road joints, or wire or strand for prestressed concrete. Send the coupon for complete information about any of these products.

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United States Steel, General Offices: Cleveland, Ohio

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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

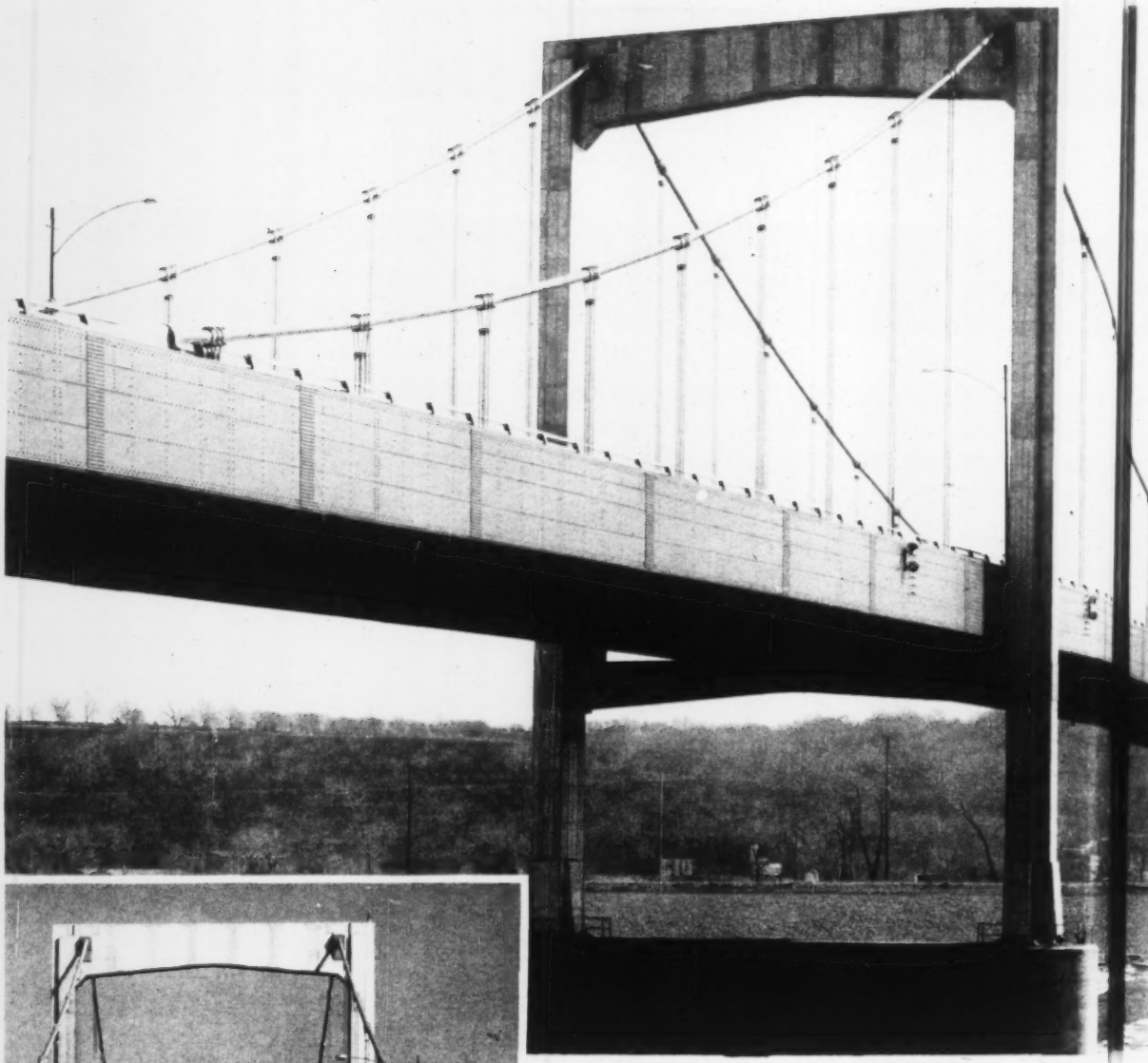
USS Multisafty Highway Guard

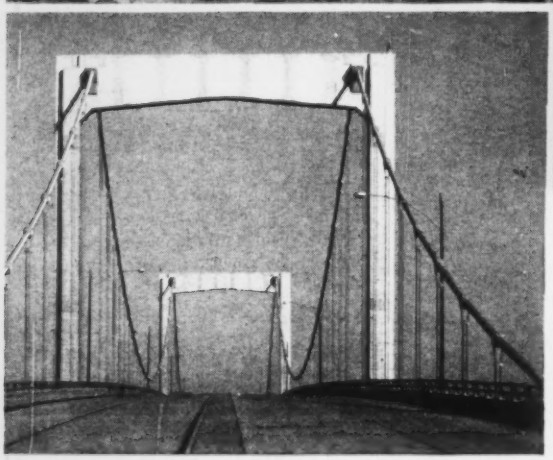
USS **UNITED STATES STEEL**

How many products does United States Steel manufacture for road builders?

Have any idea? Know what they are and how they can strengthen and protect your roads? The ads in this 8-page unit describe some of them, but there are many more. You can learn all about the entire line of USS Road Building Products at the ARBA Road Show. Be sure to visit the United States Steel exhibit. You'll see an animated display showing how and where these quality products are put to work in the step-by-step construction of a model highway. Don't miss it! The United States Steel Exhibit at the ARBA Road Show, International Amphitheater in Chicago, Jan. 28 through Feb. 2.

Longest **self-anchored** suspension built with American Tiger Brand





The main cables and suspender cables were engineered and fabricated by American Steel & Wire Division. The main cables are built up of 37 strands each for a total of approximately 94,350 feet of Tiger Brand Galvanized Bridge Strand.

The Right Wire Rope will do the trick!

bridge in the United States

Pre-stressed Bridge Strand

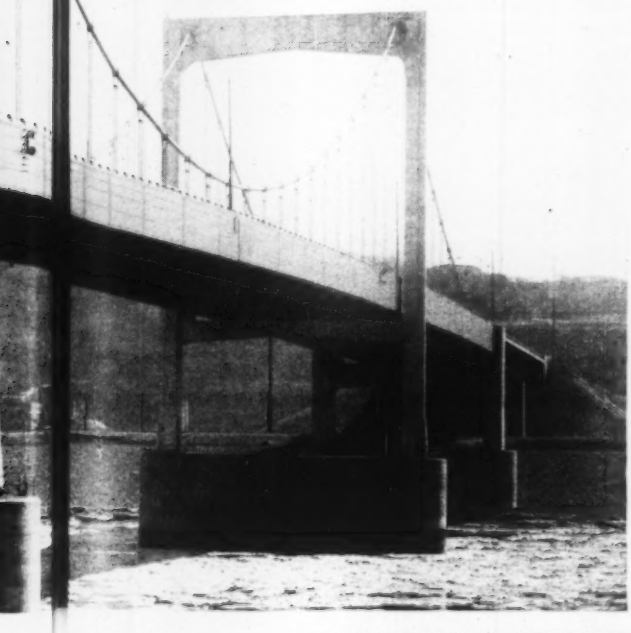
The Paseo Bridge

at Kansas City

This 1,232-foot bridge spans the Missouri River and is the longest self-anchored suspension bridge in the United States. The total length of the bridge, including two deck plate girder spans is 1,825 feet. Vertical clearance above high water at center of main span is 55 feet.

Engineers: Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

Contractor, Fabricator and Erector: American Bridge Division, United States Steel Corporation.



THE PASEO BRIDGE over the Missouri River at Kansas City, Missouri, is unique by comparison with other suspension bridges because it is self-anchored. That is, the stiffening girders themselves are designed and utilized to resist the tension of the main cables, instead of having huge anchorages at each end to resist this force.

This bridge has a 616-foot main span and two 308-foot side spans. Main cables are 12 inches in diameter and are built up of 37 strands—31 strands $1^{15}/_{16}$-inch diameter plus 6 strands $1^{1}/_{4}$-inch diameter. The cables are approximately 1,275 feet long and have a total combined strength of 27,500,000 lbs. To complete the main cables, galvanized soft steel wire is spirally wrapped around the combined strands to protect the cable and provide a smooth surface for painting.

Before shipping, the strands were pre-stressed to one half of their designed breaking strength for several hours. This is not only a thorough test of the quality of the material, but also produces a cable strand that will not stretch over the years due to use.

The stiffening girders carrying two 26-foot roadways are suspended from the main cables by 90 $1^{1}/_{2}$-inch diameter galvanized suspender ropes each having a breaking strength of 104 tons. They were also pre-stressed and fabricated to exact dimensions to fit their places in the structure without further work or adjustment.

American Steel and Wire Division is eminently fitted to handle important jobs like this. It has the engineering experience and complete manufacturing facilities to produce the finest bridge strand you can buy. Call or write for further information.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

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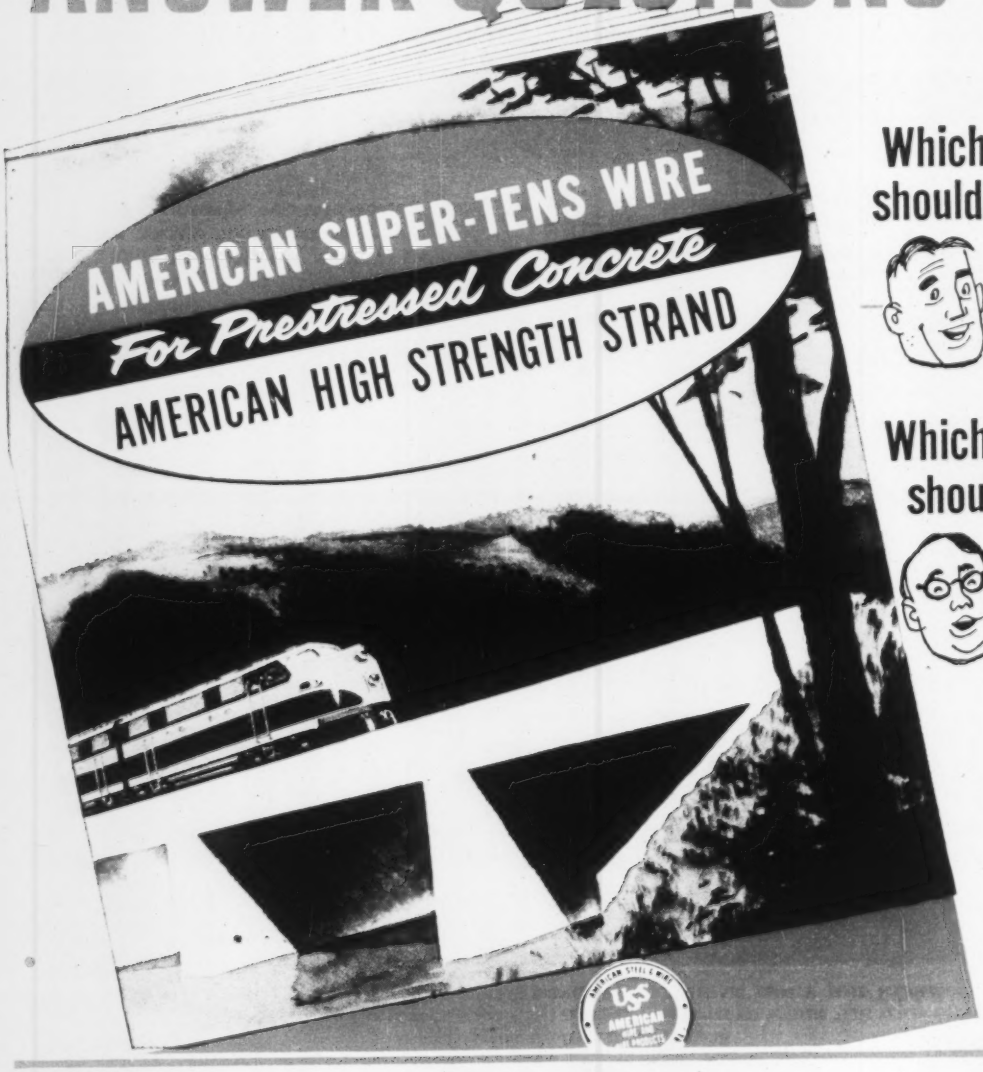
USS AMERICAN TIGER BRAND WIRE ROPE USS

Excellay Preformed

UNITED STATES STEEL

If you're using prestressed concrete...

THIS NEW BOOKLET ANSWER QUESTIONS LIKE



Which WIRE should I use?

Which FITTINGS should I use?

USS AMERICAN *Super-Tens* WIRE & HIGH

HELPS THESE

Which STRAND should I use?

What TENSION LOAD should I use?

SEND THIS COUPON FOR A FREE COPY. This new 16-page booklet describes the complete line of high strength wire, high strength stress-relieved strand, and end fittings manufactured by American Steel & Wire. It contains stress-strain curves, typical tensioning loads and breaking strengths for American Super-Tens Wire and American High Strength Strand—quality products that are especially made for use in prestressed concrete. Send for your copy.

AMERICAN STEEL & WIRE DIVISION

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Please send your descriptive booklets and information on the following:

- ☐ American Super-Tens Wire and American High Strength Strand
- ☐ American Products for Highways and Streets Catalog
- ☐ American Road Joints
- ☐ American Welded Wire Fabric for Portland Cement Concrete
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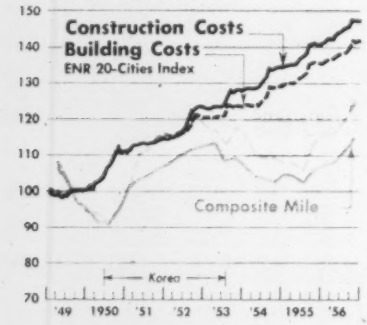
STRENGTH STRAND

UNITED STATES STEEL

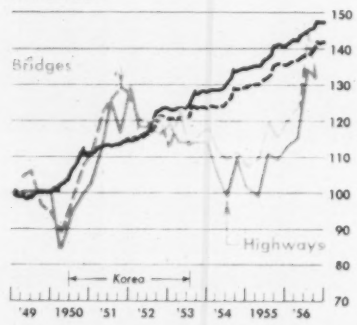
Rising Cost

The brilliant records contractors have achieved in holding down their highway bid prices in the face of rising costs are shown in these charts. Know-how, mechanization, standardization, competition—all have contributed to these past records. Now comes their biggest challenge to even greater productivity.

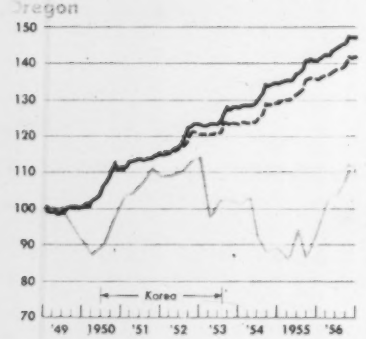
Bureau of Public Roads



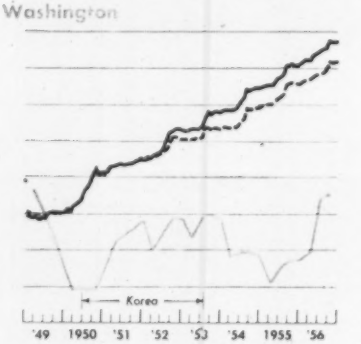
California



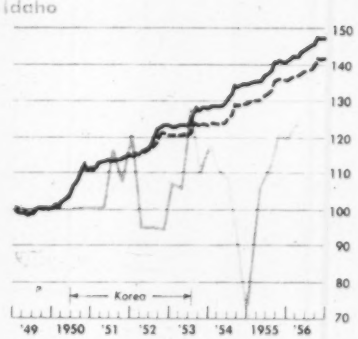
Oregon



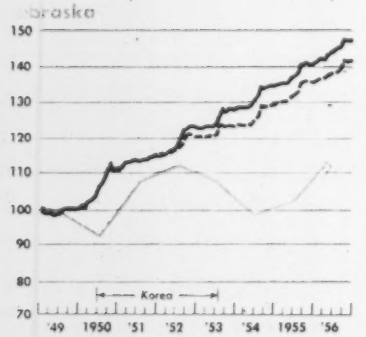
Washington



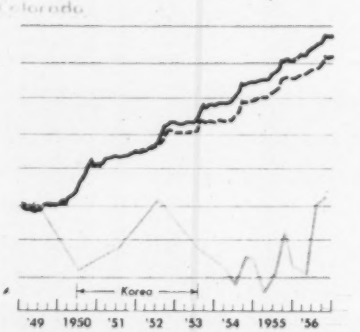
Idaho



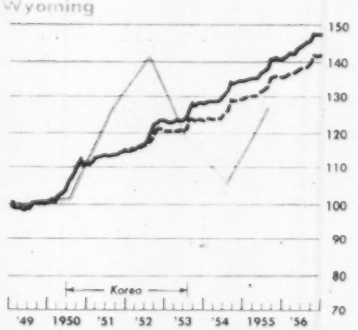
Nebraska



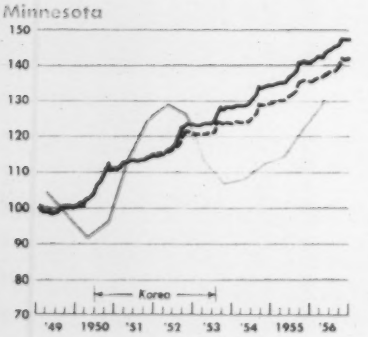
Colorado



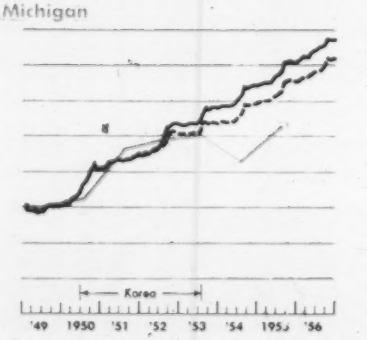
Wyoming



Minnesota



Michigan



Mississippi

st Challenge Highway Contractors

of unit prices that serve the same purpose. These highway bid price indexes are plotted here against the ENR cost indexes to show the productivity that has already been achieved by highway contractors. The ENR indexes measure the trend in the cost to contractors of their labor and materials. The bid price indexes measure the trend in the prices paid contractors for their finished product. The wide white gaps on the charts result from a combination of good management and mechanization plus some low profit margins, when the competition gets hot.

The extent of mechanization on highway construction has been measured for the American Road Builders' Association by its Task Force 3, which reports that, on the average, $2.05 worth of highway construction is accomplished per $1.00 of equipment used. This gives a ratio for each $1.00 worth of construction of $0.488 worth of equipment used. A comparison of price rises and these mechanization ratios is shown in the following table:

1926 100	1956 Sept. (S) 3rd Q (3)	Mechanization Ratio
ENR Indexes Construction Cost	338 9 (S)	0
Building Cost	270 3 (S)	0
BPR Indexes Composite mile	161 7 (3)	0 493
Earthmoving	108 3 (3)	1 320
Surfacing	174 7 (3)	0 532
Structure	251 2 (3)	0 291

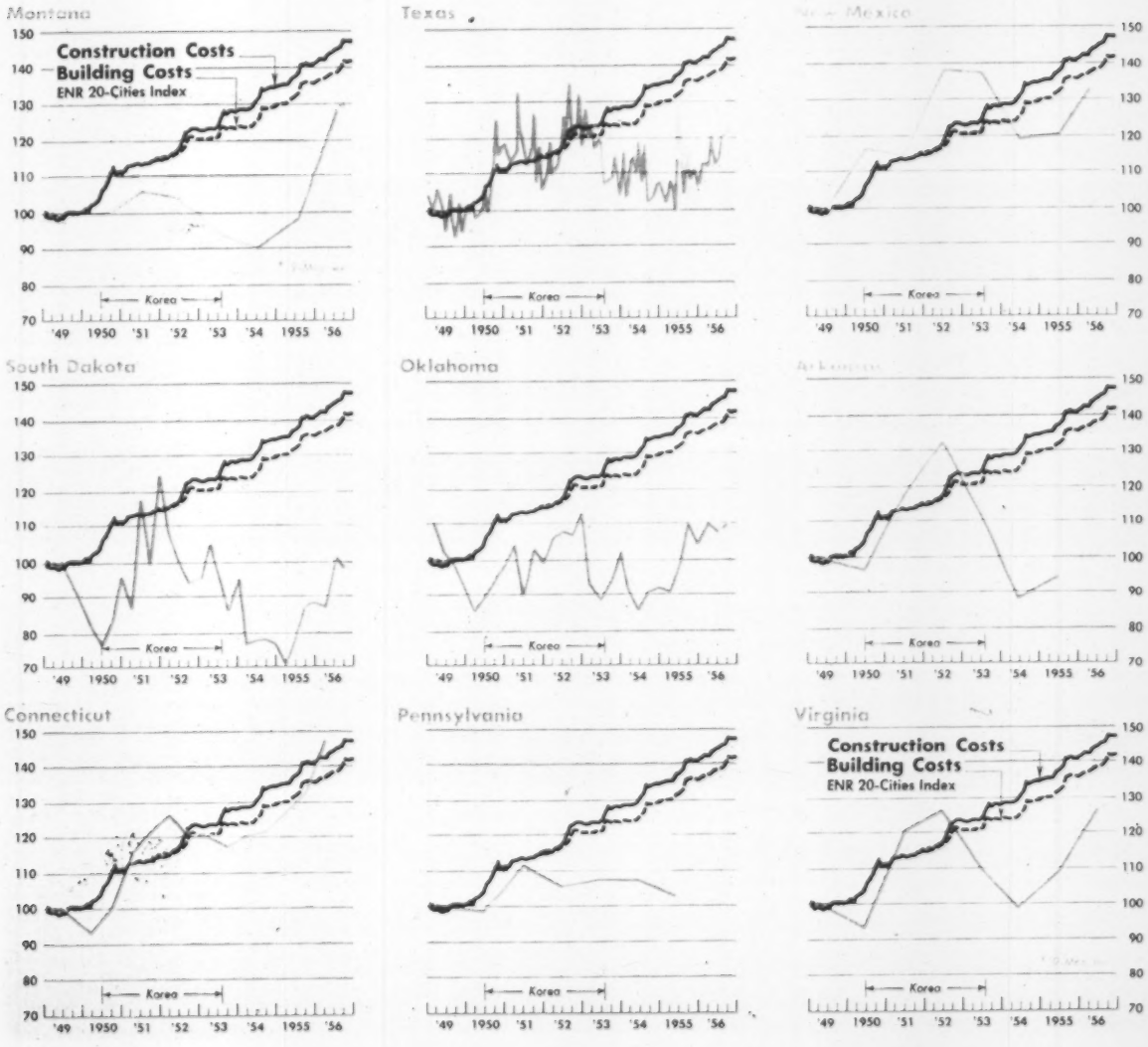
The dramatic story told by these figures is this: in 30 years while construction materials and common labor costs increased 239%, earthmoving prices are up only 8%, and structures prices up 151%. On earthmoving the mechanization ratio is 1.32, on structures it is 0.291.

With such accomplishment as background, further increases in productivity would seem to be possible.

But let's examine where opportunity lies. First, let's review. Where the Highway Dollar Goes. ENR 12-30-54. The table on page 91 shows that the biggest drain on the highway dollar is for materials and supplies, 29.9 cents.

Next to materials and supplies, on-site labor takes the biggest bite, 21.7¢ of the highway dollar. Task Force 3 says that 1 man-hour of labor produces $9.11 worth of highway construction. This gives a labor ratio per $1 worth of

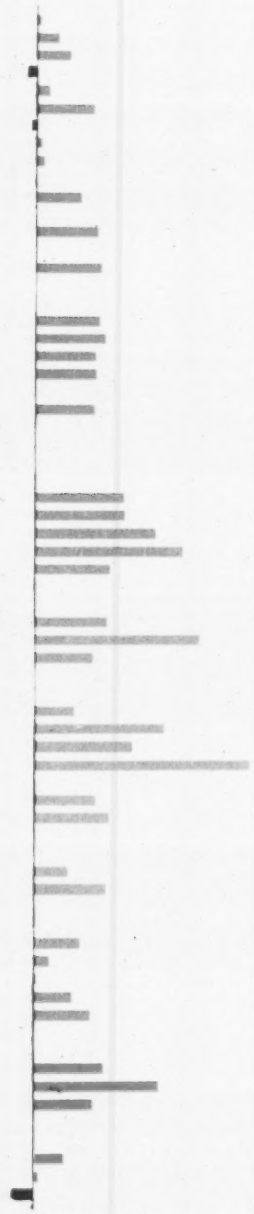
(Continued on page 90)



Highway Cost and Price Changes, 1952-56

HIGHWAY CONSTRUCTION
Average, All Types of Work
$1.00 out of each highway dollar
Each $1.00 of construction needs:
49.3¢ Investment in Equipment
0.11 Man Hours of Labor

	% Change
Bid Price Indexes	
Bureau of Public Roads, Composite Mile	+ 2.2
California, Bridges	+ 8.8
Highways	+ 12.6
Oregon	— 9.3
Washington	+ 5.8
Idaho	+ 22.5
Texas	— 1.8
Oklahoma	3.7
South Dakota	+ 3.9
Minnesota	+ 0.3
Connecticut	+ 16.9
Construction Cost Index, ENR	+ 23.2
Construction Machinery Prices, BLS Aver	+ 24.1
Wages, ENR 20-cities Averages	
Equipment Operators, 7 types	+ 23.25
Common Labor	+ 25.0
Carpenters	+ 21.6
Iron workers, structural	+ 22.2
Materials, Steel, Cement, Lumber, ENR	+ 21.2
MACHINE, LABOR & FUEL COST	**% Change**
Tractors,	
to Buy, Price Index	+ 31.7
to Rent, 72 95 hp, Crawl	+ 31.6
96 131 hp, Crawl	+ 43.3
136 190 hp, Wheel	+ 51.6
to Operate, Wages	+ 27.2
Shovels & Cranes,	
to Buy	+ 25.7
to Rent, ¾ cy	+ 57.6
to Operate, Wages	+ 21.0
Scrapers & Graders,	
to Buy	+ 15.1
to Rent, 17 22 cy	+ 45.6
Graders, 4 3 7 t	+ 35.2
9 5 10 5 t	+ 75.9
to Operate, Wages	
Scraper, 15 16 cy	+ 22.0
Motor Grader	+ 27.0
Trucks,	
to Buy	+ 13.1
to Operate, Wages	+ 26.2
Air Compressor,	
to Buy	+ 17.1
to Rent, Gas 105 160 cf	+ 6.1
160 210 cf	+ 1.4
Diesel 421 500	+ 13.7
to Operate, Wages	+ 20.0
Air Tools, Hand Held	
to Buy	+ 24.5
to Rent	+ 44.2
to Operate, Wages	+ 21.0
Fuel & Lubricants,	
Diesel	+ 10.7
Gasoline	+ 1.9
Lubricants	— 7.4



Sources: Prices, BLS Wholesale Price Index
Rentals, Associated Equipment Distributors
Wage Rates, ENGINEERING NEWS-RECORD
Fuel & Lubricants, Independent Petroleum Assn. of America

. . . Rising Costs Challenge

construction of 0.11 man-hours. By type of work, the impact of labor costs on highway construction is:

Type of Highway Work	Labor Ratio Man-hr $1	% of all Highway Const'n
Average	0.11	100
Earthmoving	0.13	25
Surfacing	0.095	39
Structures	0.113	25
Other	0.132	11

Construction equipment takes only 14.7¢ plus 2.8¢ for the fuel and lubricants counted under materials. And here is the big challenge to skilled management.

Task Force 3 has analyzed equipment use by size of contractor as shown in the accompanying table.

Annual Volume By Size of Contractor

	Value of Work in Place per $1 of Equipment Used
$5 million or more	$4.50
$1 million $5 million	2.54
$500,000 $1 million	2.04
$250,000 $500,000	1.56
Less than $250,000	0.90
By Types of Work	
Earthmoving	$0.76
Surfacing	1.88
Structures	3.44
Other	3.77
All types	2.02
Average	$2.03

Interpreting these figures, Task Force 3 reports: "This increase in the productivity of equipment is due to the higher degree of mechanization of the larger contractors, their ability to use the best machine for the job and the fuller utilization of equipment because of the larger amounts of work they have underway."

Before indicting the smaller contractor let's consider "the mix" of types of work and remember that earthmoving takes 5 times as much equipment as structures take, also that the incidence of earthmoving is much higher with the smaller contractors, the incidence of structures is higher with the larger contractors. For considering this "mix" of earthmoving and structures examine Task Force 3's values in the table above.

Even so, the trend is toward larger contractors. The larger jobs attract more bidders than do the small jobs. Moving onto a job and cleaning up and moving off are where profits are made and lost. Larger jobs can absorb these terminal costs better than a small one can.

Where the Highway Dollar Goes

			¢
Right-of-way and Engineering			20 0
Materials and Supplies			29 9
On Site Labor			21 7
Equipment			14 7
Miscellaneous, Overhead and Profit			13 7
			100 0
Materials:			29 9
Aggregates	5 60		
Cement	3 36		
Ready-mix Concrete	1 92	10 88	
Steel, Structural	4 20		
Reinforced	2 20	6 40	
Asphalt, Tar, Road Oils	2 80		
Pre-mixed Bituminous	1 76		
Fuel and Lubricants		2 84	
Pipe Concrete Culvert	1.21		
Metal	0 84		
Clay	0 08	2 13	
Lumber	0.96		
Piling	0 16	1 12	
Explosives		0 32	
Other		1 59	

As the bigger companies form joint ventures to pool resources on still bigger jobs, possibly the smaller contractors can improve their competitive position through joint venturing.

The Price Picture as of Now

To see how we stand, cost and price wise, as the big new highway program shifts out of neutral into low gear, let's examine in detail how we stood in November 1956 compared with the 1952 peak in highway prices that followed the Korea upset.

Note in the accompanying charts that highway prices are up only 2.2% on the average as measured by the Bureau of Public Road's Composite Mile Index. Yet the ENR Construction Cost Index is up 23%, construction machinery prices are up 24%, equipment operator's wages are up 25%, common labor wages are up 25%, carpenters' and structural iron workers' rates are up 22%. Materials, steel, cement, lumber are up 21%.

These are the averages. The charts show how the prices that contractors bid are moving compared with the

Highway Cost and Price Changes, 1952-56

EARTHMOVING
$0.25 out of each highway dollar
Each $1.00 of earthmoving needs:
$1.32 Investment in Equipment
0.13 Man Hours of Labor

	% Change
ENR Construction Cost Index	+ 23 2
USBPR Composite Mile Index	+ 2 2
Excavation, USBPR, common	+ 4 9
Calif., roadway	+ 5 5
Idaho, unclassified	+ 38 2
So. Dak., roadway	— 13 8
Colo., unclassified	+ 28 9
Pa., Cl 1	+ 2 7
Cl 2	— 14 0
Miss., unclassified	— 32 7
Va.	— 22 1
Wyo.	— 29 4
Grading, Conn., and drainage	+ 17 8*
Ore.	+ 7 9

SURFACING
$0.39 out of each highway dollar
Each $1.00 of surfacing needs:
53.2¢ Investment in Equipment
0.095 Man Hours of Labor

	% Change
USBPR Composite Mile	+ 2 2
Surfacing	+ 7 0
Pavement, Calif., PCC	+ 21 6
Conn., Conc	+ 21 0*
Ore., PCC	+ 6 5
Colo., Conc	— 6 4
Pa., RCC	+ 16 1
Miss., RCC	— 44 4

STRUCTURES
$0.25 out of each highway dollar
Each $1.00 of structures needs:
29.1¢ Investment in Equipment
0.113 Man Hours of Labor

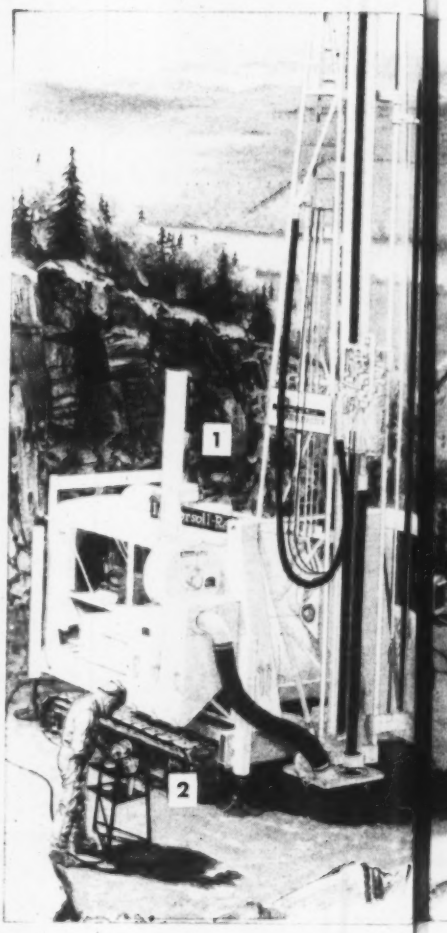
	% Change
Structures, USBPR	+ 2 8
Calif., PCC	+ 16 8
Conn.	+ 8 2*
Miss., concrete	— 19 9
Bridges, Calif.	+ 8 8
Ore., concrete & structures	+ 0 8
Concrete, USBPR, structures	— 1 3
Idaho., Cl A	+ 43 4
So. Dak., Cl A	— 9 1
Colo.	+ 3 4
Pa., Cl A	— 2 5
Cl B	— 12 7
Va., structural	— 25 4
Wyo., Cl A	— 8 2
Lumber, ENR 20-cities Aver.	+ 8 3
Sand, ENR 20-cities Aver.	+ 17 1
Cement, ENR 20-cities Aver.	+ 14 8
Steel, Reinforcing, USBPR	+ 6 3
Calif.	+ 28 7
Idaho	+ 18 9
So. Dak.	— 8 1
Pa.	+ 4 3
Miss.	— 6 5
Va.	— 15 6
Steel, Structural, USBPR	+ 5 1
Calif.	+ 34 8
So. Dak.	+ 8 8
Colo.	+ 64 0
Miss.	— 23 1
Wyo.	— 8 3
ENR, mill price	+ 37 0

* June '52 June '56

Sources: Cost Index, ENGINEERING NEWS-RECORD
•Bid Prices, State Highway Departments and U.S. Bureau of Public Roads
Materials Prices, ENGINEERING NEWS-RECORD

How I-R Equipment fits into the

...helping to meet contract dates every bit of the way



1 **DRILLMASTER** Completely self-contained, self-propelled blast-hole rig for rotary or percussion drilling with the advanced design "down-the-hole" drill.

2 **BIT GRINDER** Air-powered hand grinding unit and stand for fast, on-the-spot resharpening of large-size Carset Jackbits.

3 **WAGON DRILLS** Provide complete flexibility for fast, efficient drilling in any position. Easily moved about by hand or with air hoists mounted on the unit.

4 **JACKHAMERS** A complete line of hand-held drills with the right combination of weight and power for secondary drilling jobs.

5 **GYRO-FLO PORTABLE COMPRESSORS** Smooth-running, dependable, virtually maintenance-free rotary air compressors in sizes from 85 to 900 cfm.

6 **CRAWL-IR** Completely new, self-propelled, air-powered, crawler-mounted drill, with hydraulic or manual control of drill tower tilt and swing.

7 **HYDRA-BOOMS** Gyro-Flo powered and mounted on a truck or tractor, they speed multiple hole drilling at any angle.

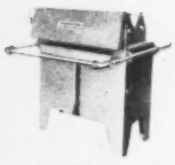
8 **QUARRYMASTER** The larger completely self-contained and self-propelled blast-hole drilling rig for drilling large diameter holes with "down-the-hole" drill.

9 **FORM-PIN DRIVERS** Standard I-R Paving Breakers with special front-heads, drive pins as fast as you can set them.

10 **DUAL-DRILL RIG** Specially designed for simultaneous two-hole drilling in trench work.

OTHER I-R EQUIPMENT FOR ROAD BUILDING

Carset Jackbits


Bit & Rod Shop Equipment

Jackdrills and Jacklegs

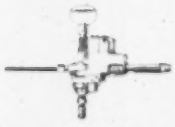
Paving Breakers

Paving-Breaker Accessories

Air Diggers

Backfill Tampers

Sump Pumps


Air Drills

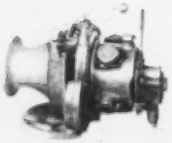
Impactools

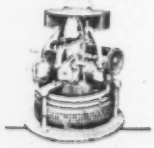
Multivane Grinders

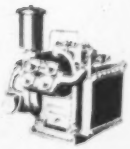
Riveters and Chipping Hammers

Concrete Vibrators

Air Saws

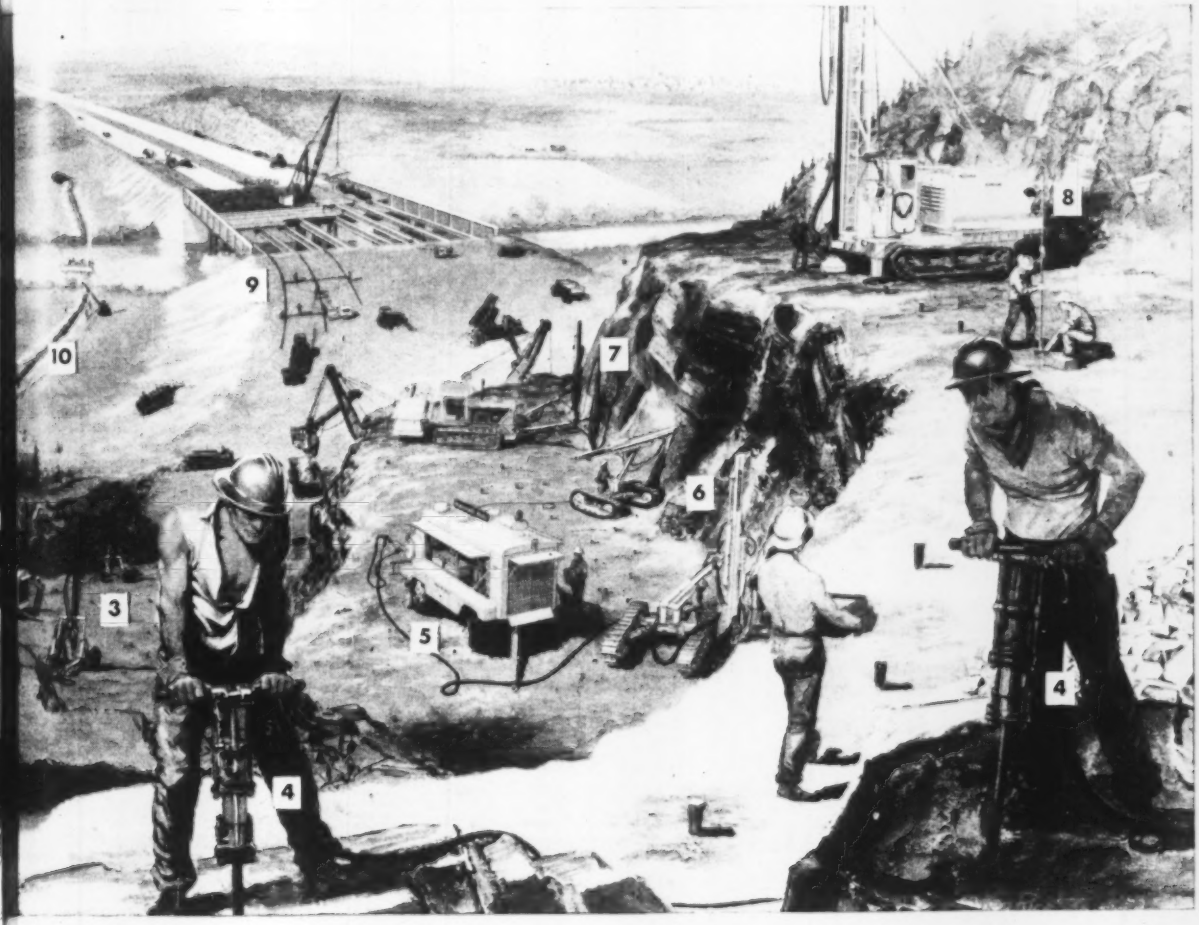

Air Hoists


Spot-Air Compressors


Stationary Compressors

Motorpumps

Highway Construction Picture



FROM big rock cuts to form-pin driving and backfill tamping, Ingersoll-Rand air power equipment plays a leading role in modern highway construction.

The first and biggest job on many sections is to *get out the rock* – and that's where the complete I-R line of rock drills and compressors can speed up the work every bit of the way.

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Work-saving air tools cut costs on bridge and structural steelwork, on wood forms and shoring, concrete vibrating and literally hundreds of jobs where operator fatigue can be reduced by use of low-cost Ingersoll-Rand air power.

Shown here are the major items of Ingersoll-Rand equipment for modern highway construction – all designed and built to work together as a time-saving, cost-saving *Contractors' Combination*. For the complete story, be sure to see the Ingersoll-Rand exhibit, Booth No. 712 at the Road Show – or write for your copy of Bulletin No. 202D.

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. . . Rising Costs Challenge

changes in prices they have to pay for manpower, machines and materials.

The Competition Picture

The productivity reported here has been achieved in spite of the fact that contractors were working in 1955 at only 49% of their capacity (Task Force 5).

The pioneer study of contractor capacity by ENR, August 20, 1953, showed that they could handle 50% more work than they then had in hand.

In 1954, with the big increase in highway construction in sight, highway contractors then working at just under 51% of their capacity, reported to ENR, December 30, 1954, that they could increase their capacity by:

50% the first year
80% the second year
100% in three years.

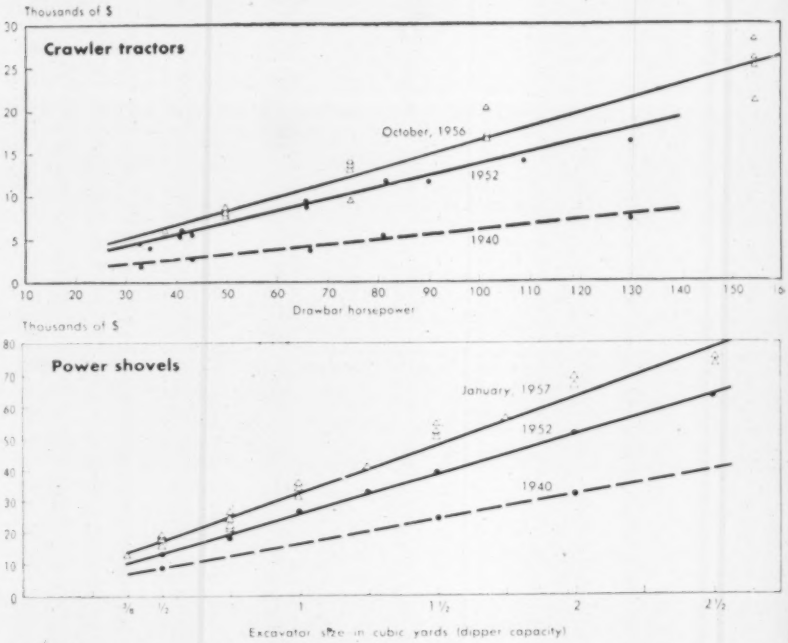
The Task Force 5 study indicates that they were working in 1955 at 49% of their overall capacity. By type of work these variations show up: on earthmoving they were working at 45% of capacity, on surfacing at 46%, and on structures at 47%.

This would indicate that competition, the driving force back of high productivity, should continue strong even with the rising volume of work under the interstate program.

The number of bids per contract, however, has shown a marked drop, 15 to 23% on a national average, up to 58% on some California jobs since 1954.

New York State, as tough as they come on awarding contracts only on bids below the engineer's estimate, averaged 2.8 bids per project on its big December 20 letting, 2 bids per project on December 27, 3 bids per project November 15, both smaller lettings. Four projects out of 25 drew no bids, five drew only 1 each and one drew only 1 bid and that over the estimate. It was immediately rejected.

This is evidence of how the lines are being drawn in the battle against rising costs.



Number of Bids Per Contract

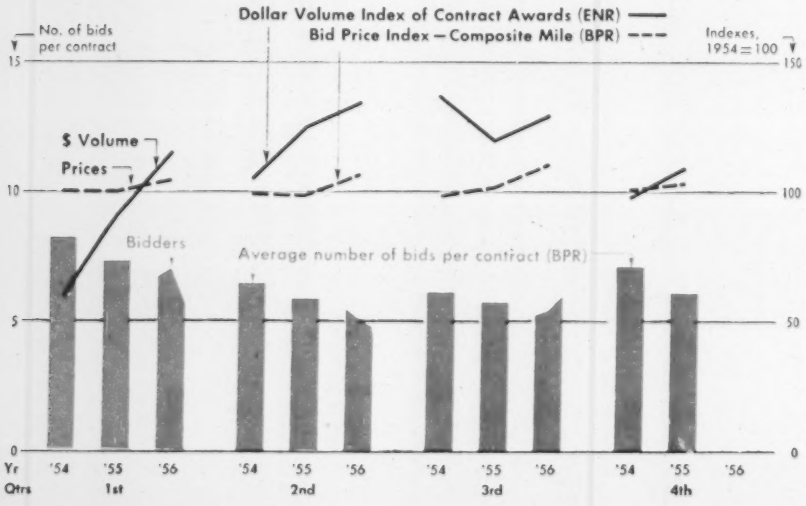
		Min. Month	Max. Month
BPR	1954 Q4	6.1	8.1
	1956 Q3	4.7(−23%)	6.9(−15%)
Calif.	1954—12 mo	5.7	8.8(−33%)
	1956—9 mo	3.3(−42%)	5.9(−33%)

By Size of Contract—California

Size of Contract	1954 July-Dec	1956 Jul-Sep	% Chg
Up to $50,000	5.2	3.3	−37
$50-$100,000	6.4	3.9	−39
100-250,000	8.5	5.1	−40
250-500,000	9.9	4.2	−58
500-1,000,000	8.6	3.6	−58
Over $1,000,000	10.2	5.3	−48

Competition Drops Off as Volume Rises

Number of Bidders per Contract Declining



Opportunities Ahead

The stepped up volume of available work offers great opportunities to highway engineers and contractors to improve their productivity and hold down bid prices through:

- Good design for efficient field operations
- Intelligent timing and scheduling of lettings to develop maximum competition
- Lower ratio of overhead to be absorbed per dollar of volume
- Tighter scheduling and fuller use of equipment—more operating hours per year per machine
- More selective mechanization—the most efficient machine for the job in hand

Materials prices and wage rates will continue to reflect the general economic climate of the nation. This trend is up for the forseeable future.

And this means that we must look to continuing strong competition and the satisfactions and rewards of good management if we are to get the maximum mileage out of those billions of highway dollars.

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Night driving is safer with this glistening strip of white concrete stretching ahead. Drivers can see every curve and slope far ahead of them, in ample time.

For day driving, white concrete curbs stand out in contrast to darker paving. At night, the curb's saw-tooth surfaces reflect headlight rays back to the driver. And on rainy nights, when the need for visibility is greatest, the wet curb surface becomes even more reflective.

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Interstate Highway File:

- ☐ Prospects and Problems
- ☑ Design
- ☐ Construction
- ☐ Costs

Already staggering under the impact of the greatest construction boom in U.S. history, professional men, too, are looking to new machines and methods, as . . .

MACHINE LETTERER, moving over engineering print, saves manual lettering of drawings.

Engineering Begins To Move To M

Until very recently, civil engineering might correctly have been called a static profession. While elements of design criteria have changed greatly over the years—with changes in specifications, loadings and techniques born of new construction materials and equipment—office and field engineering practices have followed closely the patterns set up more than a century ago.

But the postwar spurt of construction generated more work than the nation's engineers could handle, even without the further burden imposed by the national highway program. Sheer necessity now has forced an almost frantic search for new methods, revolutionary engineering tools and an unprecedented review of the profession's own shortcomings.

Engineers have had no alternative but to make an intensive study of their own time-honored methods and use of manpower. The study has been rewarding. It has shown the way to more sensible and economical employment of the skills now available. The search for machines and methods is still at its beginnings, but has already produced remarkable results.

• **Manpower**—Any discussion of engineering tools has to start with the principal one: the civil engineer himself. Here's a tool that can't be mass-produced, that must depend on the necessarily slow educational requirement and the existing facilities of the technical schools.

Despite growing demand for competent civil engineering graduates, it is clear that engineering colleges will not be able to catch up to an annual deficit of more than 1,500 civil engineers, let alone increase the available supply in the immediate future.

The only possible personnel solution (and its effectiveness has been proven during recent years) is to increase productivity of engineers already employed in construction. And it is possible to increase output surprisingly, merely through a planned re-application of technical manpower.

First step is a detailed analysis of every job, classifying each according to the degree of professional experience and knowledge required. Broad classifications might be: Technical Administrative, Technical Design and Production, Technical Supervision, Semi-technical and Non-technical. These groups then may be further separated into segments—those that require professional knowhow and those that do not.

Next step is to shift non-technical duties from the shoulders of engineers to those of competent non-technical people. Thus, routine gathering and transcribing of field records, ordering of supplies and materials, approvals of time slips, drafting, even some design, are no longer the engineer's prime concern.

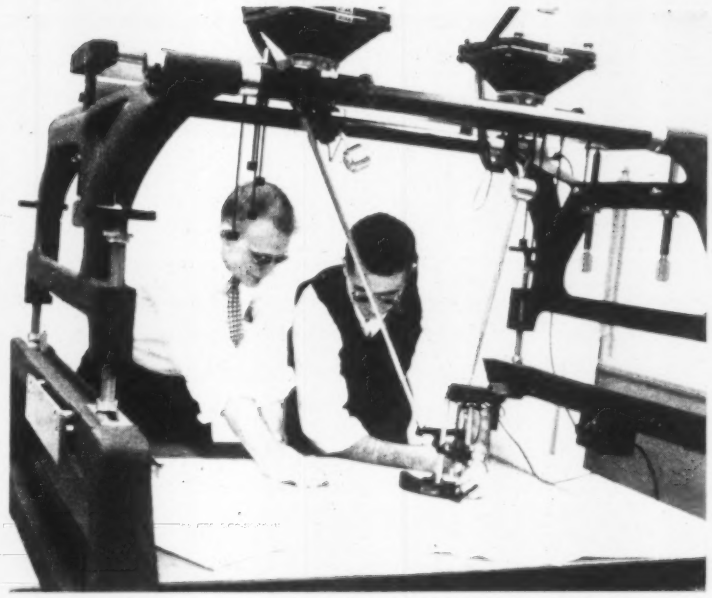
The advantages multiply. Engineers now can take on a greater work load than could have been performed even with additional technical staff. Trained technicians or high school graduates with a background of courses in mathematics or science are more readily available, can look to a broader opportunity for advancement to executive status, despite the lack of full professional training. And new engineering graduates can attain professional status much more quickly.

• **Only a beginning**—Realignment of engineering duties is, however, only the beginning of the search for methods to increase productivity. Agencies like the U.S. Bureau of Public Roads, the Highway Research Board and associations such as the American Road Builders Association and the American Association of State Highway Officials have conducted studies and conferences—jointly and individually—aimed at improving engineering methods and procedures.

The results of these efforts are not far short of startling. Out of them and from individual efforts of industry and state highway departments has evolved a solid framework of unusual engineering methods that will form the skeleton for a dynamic new concept of highway planning, design and construction never before believed possible.

A glossary of terms not normally associated with engineering only 15 years ago, but now in everyday use, would fill a page. But there are a few that stand out as descriptive of the new look in civil engineering.

• **Photogrammetry**—This term, often



STEREO PLOTTER is of a type most commonly used for highway location and design. Cross sections can be read without conventional equipment.

STEREO PAIR gives photo-geologist information on formations in area of photo.

To Meet Road Challenge

confused and improperly interchanged with aerial photography, is defined by the American Society of Photogrammetry as "the science or art of obtaining reliable measurements by means of photography", with amplification to include "interpretation of photographs."

The broad types are set up as ground photogrammetry, aerial photogrammetry and stereo-photogrammetry. The latter, most valuable in the highway field, is observation, measurement and interpretation of overlapping pairs of photographs in a stereoscopic viewing device, which gives the observer an illusion of a three-dimensional view.

Neither photogrammetry nor stereoscopic plotting is new in concept. The groundwork was laid in Europe in the mid-nineteenth century, within a decade after the first known photograph (daguerrotype) was produced in 1839. A practical stereoscopic plotter was invented in the latter part of the century by Capt. E. Deville, Canada's Surveyor General of Dominion Lands, and the floating mark (by E. Stolze) and its subsequent development into a practical method of measurement by Dr. C. Pulfrich established the principles that govern modern photogrammetric mapping procedures.

But real impetus for fast development was provided by World War II. Topographic maps obtained through aerial and stereophotogrammetric methods charted the course of every campaign, and the speed and accuracy with which these maps were turned out proved to be one of the most valuable factors in modern warfare.

Adaption of stereo-photogrammetry to peacetime applications, however, required more than a transfer of equipment from military to civilian aircraft.

Degrees of accuracy for military tactical mapping do not approach those necessary for final quantity estimation, highway planning, location and construction. While most of the equipment and methods for more precise mapping were known prior to the war, many refinements have had to be introduced to handle road work.

According to the ASP, the major problems that have confronted photogrammetists have arisen from these facts:

- It is seldom possible to obtain and preserve the original negatives under uniformly ideal conditions.
- It is seldom possible to transfer the information contained in the original photographs (or negatives) to the map compilation with complete accuracy.
- The surface of the earth is neither flat nor smooth.

The association lists nine chronological requirements that must be fulfilled in order to have an ideal condition. Most are conditions of the camera relative to the aircraft: for example, exposure at the exact position and altitude selected, keeping the position of the optical axis of the lens truly vertical at the instant of exposure and orientation of the camera in azimuth at the instant of exposure.

Since existing equipment won't meet the ideal requirements, methods have been developed for practical measurement of known deviations and application of appropriate corrections and rectifications.

Answer to the second general problem—accurate transfer of information—lies mainly in extreme care in development of original negative films and plates, the transfer of detail to prints and the use of proper materials.

Among the special problems in this regard are selection of print material that is least affected by changes in humidity, temperature and normal wear. For instance, developments of the past two years have provided much better materials in paper, linen and plastics than have heretofore been available.

With the increasing demand for dimensionally stable maps for engineering use, most of the problems have been solved as far as practical utility is concerned, and research and development programs are continuing with the aim of even greater accuracy.

• Highway applications. Every phase of planning and design of highways can be guided by photogrammetry.

Traffic studies can be supplemented by periodic aerial photographs to ascertain traffic volumes and patterns of use of roads. These photographs normally are taken with a single-lens cone, since three-dimensional views are not important. Reconnaissance maps then are flown to provide information for route selection. These maps are usually 1:15,000 or 1:20,000 scale, presenting a relatively large area along the proposed general route of the highway, and in

. . . Planning Engineer gets more information

LIGHT TABLE shows up photo negative, allows etching for very sharp reproduction of pencil originals.

most cases, sufficient data are shown on the strip to eliminate all but two or three possible highway locations.

First man to receive the reconnaissance strip is the photo geologist who plots surface and subsurface soil conditions on the map through stereo-interpretation of the photographs. He also spots borrow locations in the area.

Probably the most important feature of this use of photos is in its effect on the chronology of operation. Originally, test borings were made after the route had been selected, thus the geologic report had to be confined to soil conditions along a set right of way, with no room for choice of a route that might be more practical due to the geological formation in the area.

The planning engineer, armed with the reconnaissance maps, has much more information at his disposal than was practical under conventional ground methods, and the likelihood of more positive selection of the best route is increased greatly.

Larger scale maps are in order at this point for design purposes, and it is here that ground control becomes an acute problem. Control points are usually established on the ground by a survey crew, and location of these points is of extreme importance. At present there is a substantial program of research in progress by ASP and some of the commercial photogrammetists to provide electronic control that would further reduce ground surveying manpower needs.

With preparation of the large scale strip maps the design engineer now has all necessary topographic information at his disposal. Actual design is possible at an expenditure of an estimated one-fifth of the time and cost of conventional methods. In addition, before and after-construction records are possible without extensive use of ground crews.

• **Cross sections**—Probably the greatest time and dollar saving feature of the photogrammetric technique is that, coupled with computers, it can eliminate conventional plotting of cross sections for use in computation of excavation quantities.

It has been reported that from receipt of field information to final figures, average manhours range from 2½ to 3 per mile, as compared with an estimated 98 manhours per mile for plotting and calculations.

In jobs where photogrammetric computations have been checked by conventional means, it has been found that error has not exceeded 5%, and in most cases the error has been far less. In cases where most accurate plotting equipment is used, photogrammetists claim greater precision due to more frequent stationing.

The question of scale and contour intervals has been fairly well established for final design maps at 5-ft contour intervals on 1:200 scale for rough terrain, 2-ft intervals on 1:100 for rolling terrain and in flat country. Flights are made at altitudes of about 2,500 ft and the map is plotted on 2-ft contours. It is necessary to treat each section of highway on the basis of its own characteristics, and it is possible over several miles of highway for several scales and intervals to be used.

• **The plotters**—The degree of accuracy obtainable for use by the design engineer is directly proportional to available funds and accuracy of the photographs. Types of stereoscopic plotting machines range from the most rudimentary stereoscopes and height finders to very complex and expensive stereocartographic plotters.

The stereoscope and height finder cannot be used for mapping at all. They have their value in reconnaissance and for photointerpretation, so they are widely used by military engineers and occasionally by civil engineers.

The most commonly used and fairly accurate plotter is the second order machine, represented by such plotters as the Kelsh and Multiplex, but this machine has limitations and should be used only in certain types of mapping operations. It is known as the double projection type.

The first-order plotting machine, costing around $50,000, is so precise that it cannot depend upon a table top for leveling the photographs. It furnishes its own mount within the machine to provide first-order accuracy.

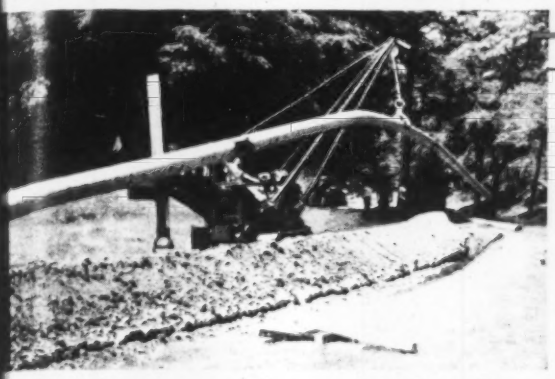
The use of such a machine, with half-mile high or even one-mile high flight projects, gives readings to tenths of feet directly from the photographs. Companies using first-order plotters have made contour and planimetric maps with profiles along the center lines of highways, but they are now set up to make cross section profiles of the ground preceding, during and after construction with a degree of accuracy that would be difficult to handle in a ground survey, according to the photogrammetists. With some of the refinements now available, 100-ft stations no longer will be standard; electronic computers, teamed with first-order stereoplotters, can give cross sections at 25-ft and even 10-ft intervals at reasonable cost.

• **The computers**—Rapid development and adaptation of electronic computers in the highway field has been one of the most significant strides in road-building—especially when they are teamed with photogrammetric mapping.

But at the outset, it is important to dispel any belief that there is magic bottled up in one of these machines. The fact that they follow pre-established detailed orders at great speed is really the only amazing feature of these electronic calculators (ENR July 12, 1956, p. 30).

The four basic parts of any computer—the input device, the control unit, the memory unit and the output device—are under constant control of a succession of specific orders or program. The program is nothing more than a very detailed list of instructions mechanically impressed on a punched card, magnetic tape, paper tape or by keyboard. It is made up of small segments of the whole problem broken down into

The CLEVELAND 80W

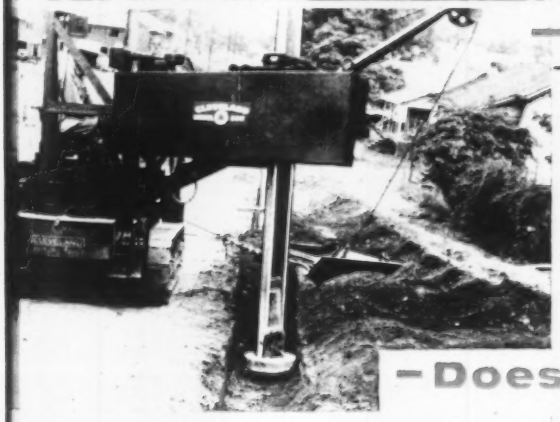


– a SIDECRANE

- Lays pipe • 30,000 Ft. Lb. Capacity
- Power Boom . . . Up and Down • 4 Line Speeds
- Long Reach . . . 21 Feet • Sets Bends, Valves
- Unloads . . . Strings • Pulls Sheathing, Etc.

– a BACKFILLER

- Backfills Fast . . . 20 Passes Per Minute
- 4½ Ft. Scraper Board • Backfills Clean
- Stays off Completed Work • Backfills from Either Side of Trench • Works Safer . . . Parallels Work • Fits All Job Conditions



– a TAMPER

- Fills and Tamps Simultaneously
- One Machine . . . One Operator Does it All
- Meets Density Specifications • Tamps from the Bottom Up • Parallels Work . . . No Straddling • Tamps Wider . . . Tamps Safer

– Does ALL 3 Related Jobs – *Better!*

In 1957 USE THE 80W AND SAVE . . . ON MONEY, MEN AND MACHINES

See It at the Road Show, Jan. 28-Feb. 2, North Hall, First Floor, Location B.

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You can depend on BLAW-KNOX PAVING EQUIPMENT EXPERIENCE for the BIG JOBS AHEAD

BLAW-KNOX PAVING EQUIPMENT
proved on Turnpikes and Superhighways across the Country

On Turnpikes and on Superhighways all across the country Blaw-Knox Concrete and Bituminous Paving equipment units have proved they have what it takes to produce big capacities to rigid specifications under tight working schedules. Among the major highway projects where Blaw-Knox equipment has been proved are: Pennsylvania Turnpike, New Jersey Turnpike, New York Thruway, Virginia Turnpike, Ohio Turnpike, Indiana Turnpike, Massachusetts Turnpike, Kansas Turnpike and the Florida Turnpike. This same equipment has proved equally successful on smaller paving projects.

In the Blaw-Knox "Complete Package" you get the most efficient concrete paving outfit available, because every piece of equipment is built by one responsible, experienced manufacturer, with each unit engineered to match the others in size, capacity and performance. Road Forms carry the Precision Subgrader, Transverse Blade Spreader and Finisher. Automatic Batching plants will keep two of the new hydraulic MultiFoote Pavers working at peak capacity.

On Bituminous Paving projects you can have the same efficient low cost production. This Blaw-Knox equipment assures you the biggest capacities for spreading the sub base material, laying the pavement mat, to finishing the shoulders. Blaw-Knox Base Pavers will spread up to 400 tons per hour of base material *without segregation*. The new Model PF-90, described on the opposite page, can handle up to 200 tons per hour of bituminous paving. The Blaw-Knox Road Widener will assure fast work of shoulder building without wasting material.

When you have a Blaw-Knox paving outfit for either bituminous or concrete paving you get preventive maintenance since all your equipment belongs to one family. It's standard practice for your Blaw-Knox trained service man to check each unit on each service call, to stop trouble before it starts.

You can get the complete story on Blaw-Knox paving equipment from your nearest Blaw-Knox distributor. Many of these high capacity units will be at the 1957 A.R.B.A. Road Show.

BLAW-KNOX PAVING EQUIPMENT

Road and Airport Forms Manual or Automatic Cement and Aggregate Bins and Batchers Precision Subgrader MultiFoote Concrete Paver Concrete Spreader (with or without Vibratory Attachment) Concrete Finisher (with or without Vibratory Attachment) Base Pavers Bituminous Paver Finisher Road Widener Trench Roller Street and Gutter Forms Concrete Buckets

Blaw-Knox 1957 Model PF-90 is even Better!

The Blaw-Knox Model PF-90 Bituminous Paver Finisher now has engineering advances that provide higher paving speeds and greater paving width. A wider range of paving speeds is provided with a new two-speed axle that gives a low working speed of 10 feet per minute to a high paving speed of 52 feet per minute. The PF-90 also has a higher travel speed of 7.4 miles per hour to give you greater mobility on between paving moves.

Another important feature of the new Model PF-90 Paver is the increased paving width. It can now lay a bituminous mat 16 feet wide, three feet wider than the previous maximum width of 13 feet. This new paving width has been tested and proved on many types of operation including the Massachusetts Turnpike.

Other important features of the Model PF-90 include the rubber tire mounting which eliminates from 600 to 700 wear parts typical of crawler mounted pavers. The PF-90 also has a big 10-ton hopper so it can take a full truck load without spillage. You can see these features and many more at the Road Show.

Blaw-Knox will show the latest and best at the 1957 Road Show

The Blaw-Knox exhibit at the A.R.B.A. Road Show, from Jan. 28 through Feb. 2, 1957 will show important equipment that you will want to plan on using in your future paving jobs. Some of the equipment shown will include: New Bituminous Paving Equipment, an Improved HiBoy TRUKMIXER, Improved Automatic Batching Equipment, the Time-tested Concrete Spreader, a Base Paver, Road Widener and a Trench Roller.

The Blaw-Knox Exhibit is located at Booth 727 in the Exhibition Hall at the International Amphitheatre

BLAW-KNOX

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CONSTRUCTION EQUIPMENT DIVISION

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GEOPHONE EQUIPMENT utilizes measurements of shock waves to determine geologic formation of ground below.

the most basic steps of subtraction, addition, division and multiplication. There is, however, one additional feature: Upon receiving an order to do so, the computer can recall any figure or element previously given it, compare it with any other, and follow the next directive as to what to do with the result. This is strictly a mechanical function, but it is performed at such great speed that it gives the impression of independent thought.

The question of how best to use the machine is best answered in terms of repetition. Since programming is a time-consuming, costly phase of computing, the larger the repetitive cycle—that is to say the more repetitions that occur in an operation—the more practical and economical is the program.

An important feature of the computer is that repetitions need not be identical as long as the principle is the same. For example, in three miles of highway design there may be four different cross sections, each of which will affect earth moving. In densely populated areas, median strips generally are narrow. In open country they are wide. At approaches to interchange locations acceleration and deceleration lanes are provided, adding to the width of pavement.

As these changes in cross section come up, the program keys the computer to the required change in earth volume computation without resetting or stopping the machine. The separate repetitions are actually similar units of a family, and the program calls each unit of the family into consideration when characteristics of the problem call for it.

• **More work for machines**—First use of computers in highway work was through development of programs for traffic and planning studies and correlation of highway safety data. Expansion of programming and its use as a valuable tool in the design phase came later.

Computation of earth quantities and uses in location and design furnished the first real opportunity for electronic machines to demonstrate their effect on conservation of technical manpower. Excavation data proved so adaptable to programming that highway departments, machine manufacturers, the BPR and AASHO began intensive campaigns of research that—since 1951—have greatly influenced engineering practices.

From these efforts have come programs in drainage, bridge design, computation of pay quantities—especially earthwork in final estimates—and in route and cadastral surveys.

With the Bureau of Public Roads acting as central agency in gathering, correlating and disseminating all information regarding use of the machines, and developing formulas for programming—where possible—all highway and structural operations, the computer has established itself as a foremost tool of the engineer, with promise of greater importance as efforts continue.

The ability of the machine to work directly from notes as they are taken from fieldbook data has been one of the most significant features in development of the many computer uses. There has been no program of re-educating or training the field engineer. The usable form of fieldbook data is much the same as that used traditionally in all field work, so there has been little or no opposition to electronic computation of design problems.

• **Radio**—But among the tools of the engineer are many that have been used for much longer than photogrammetry, computers, plotters and the like. Radio communications have been improved over the years until state highway department are linked by a network which, though born of urgency of national defense planning, cannot help but improve administration of the highway program.

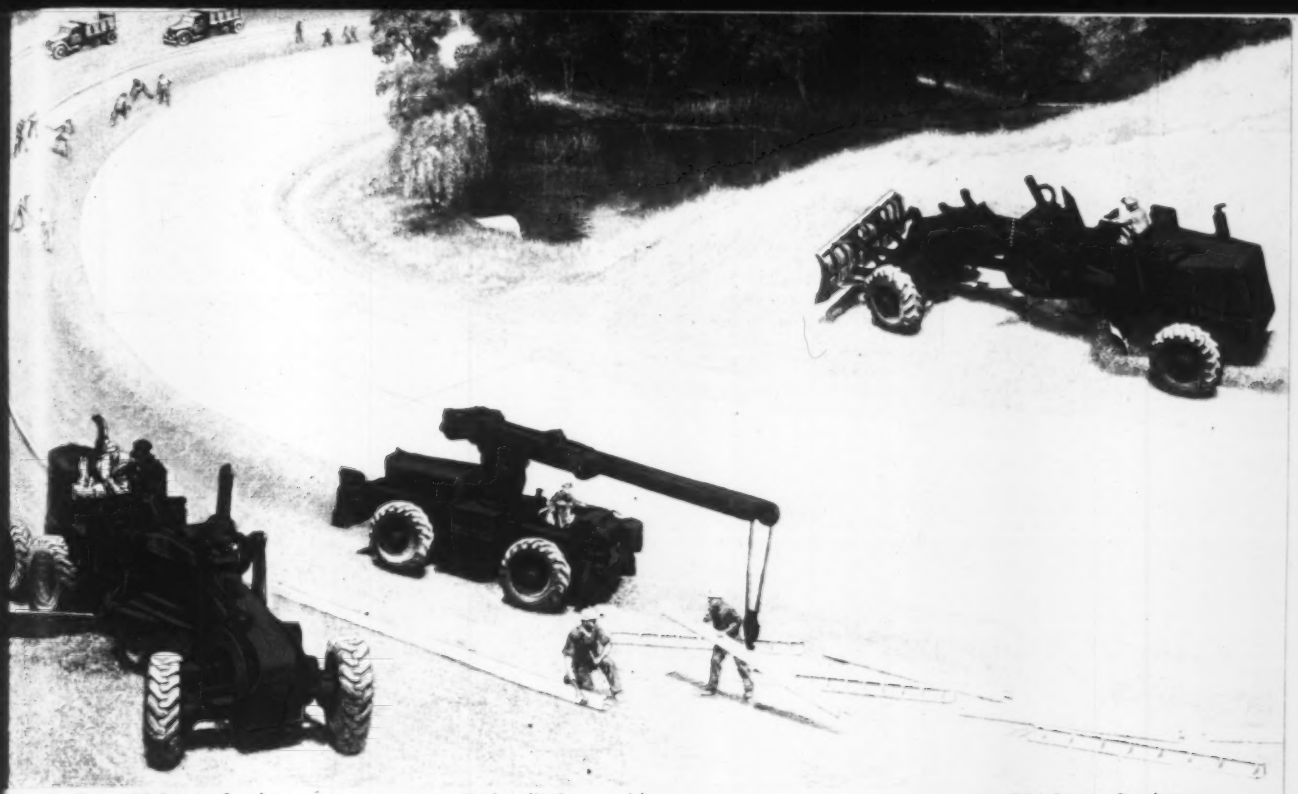
Through the use of radio communications on large projects, engineers have been able to cover a far greater range of jobs with constant supervision of all phases regardless of where their authority, experience or opinion might be needed.

One of the newest of these radio units is a development of the "walkie-talkie" that gained so much fame during World War II. This one, weighing only 8 lb, is a wet-cell operated set, with a range of 30 miles—greater than any of the war-time hand units and even greater than most of the standard police, fire and public works units that are mounted in cruising vehicles.

• **Seismological instruments**—Taking advantage of valuable information to be gained through transmission of impulses through ground structure, seismological instruments have been used for many years. However, it is only fairly recently that these instruments have been harnessed to provide the engineer with vital data on subsurface rock conditions.

The method is similar to those used in oil explorations: explosions are set off while recording devices at varying distances and different directions from the blast site plot the shock waves. Graphic analyses of these records locates the rock masses.

A further use of seismology has been pioneered by Liberty Mutual Insurance Co., Boston, to control quantities of explosives for blasting in populated areas, in order to prevent damage to property and lives nearby.



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The men who own and operate Austin-Western equipment will tell you that it's tops in its field. Graders, rollers, sweepers and hydraulic cranes all offer you more extra features than anything else in their class. That's why the A-W red is such a familiar sight on construction, maintenance and materials-handling jobs all over the world. Compare these advantages with those of any similar equipment, and you will see why it will pay you to go Austin-Western in 1957:

- **Power Graders**—Built to give 30% more power *at the blade* than ordinary graders. All-wheel drive, all-wheel steer . . . controlled traction . . . precision side-shift . . . high-lift blade (90° right or left) . . . extreme blade reach . . . completely reversible blade . . . finger-tip hydraulic controls.
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Find out more about the complete A-W line that's "Built to Outperform"—see your nearby distributor or write us for complete information.

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AURORA, ILLINOIS, U.S.A.

The company a few years ago developed what it called an accelerograph, to record and measure ground accelerations and frequencies that indicate the rates of energy being transmitted through the ground. It is known that the energy ratio is proportionate to the amount of explosives detonated at any instant. Obviously, a series of blasts will thus produce less ground tremor—and thus less annoyance—than one major explosion.

On the basis of tests, then, the insurance company provides its contractors with a formula to insure maximum safety at the blasting site and minimum likelihood of structural damage to buildings located in the surrounding area.

The same company also has developed microseismic detection apparatus for determination of incipient roof failures in rock tunnels. Consisting of a geophone, or probe, an amplifier and earphones, the instrument is gaining wide application in determining when and where a roof fall is most likely to occur.

The geophone contains two synthetic crystals, which when bent by minute earth movements generate a piezoelectric flow of current. When the probe is placed in a drill hole, inaudible movements can generate the flow. This current is carried through leads to an ordinary battery-powered amplifier some 250 ft away, and the impulses are raised to audible level through simple earphones.

• **New in the office**—A look at today's engineering offices as compared with those of ten years ago is enlightening. New machines are doing the work of many hands, lighting developments and air conditioning have changed the atmosphere, and while few are really plush, most have taken on brighter and more highly organized aspect.

Among the innovations that could spell the difference between doing a top job or losing out through inability to perform are such items as photographic reproduction equipment, square-root desk calculators, microfilm filing systems, lettering typers for work on plans and maps and photogrammetric and electronic computing devices already mentioned.

A great deal has been done to eliminate tracing by preparation of reproducible drawings from pencil sheets, through photographic means. A tracing that would have taken four days to complete now is done photographically with as fine or better results in one. Working with a photographic negative of a pencil drawing, mounted on a light table, it is possible to sharpen detail, patch or black out unwanted portions of the drawing, insert new sections or tables and change legends for repetitive plates. It is also possible to print existing highway material for a relocation survey on the reverse side of a cloth print for use on the light side.

Another important technique is use of erasible positive aerial photographic prints on dimensionally stable material. Interchange of route data can be superimposed directly on the face of the positive print, and when the design has been completed, all detail on the photographs can be erased, leaving the working drawing for use in the field.

Preparation of true negatives of original drawings can be accomplished on 105-mm micro-film, thus eliminating space-consuming storage of many of the originals. These micro-film negatives, stored in fireproof cabinets—often in two locations to insure permanent record—are capable of relieving entirely the row-on-row expense of bulk storage. And new, clean reproducibles of any size are available quickly at little cost.

Lettering machines, which work like a typewriter, except for the fact that the machine moves over the drawing instead of using a carriage and roller platen, are being used more and more in progressive engineering offices.

Printing is roughed in by the designer, and, upon completion of the drawing, all printing is typed on the finished work, with substantial savings in time and cost.

Exponential desk calculators are not brand new, but engineering offices are using them to great advantage in taking out series of square roots, often a time-consuming operation. It has been estimated that every square root takes from 45 to 60 seconds to compute manually using log tables. With the desk calculator, the time is limited to the punching of the original figures. The machine does the rest.

Air conditioning also has increased the production of an engineering staff, particularly by virtue of the humidity control that it provides. It has been found that controlled humidity has had a marked effect upon precision in drawings. Materials are dimensionally more stable; better plans result.

• **Results**—It is difficult to estimate the number of engineering manhours that can be saved—or the tremendous saving in costs—through adoption of only those methods and machines discussed in this article.

It has been figured that up to the beginning of this year, the ratio of engineering aides to professional-grade engineers was about 1½:1. But it has been proved possible to increase this ratio to 4-to-1, and it is estimated that with all facilities available today it could be further increased to one engineer for every seven technicians.

According to H. L. Plummer, chairman of the Wisconsin State Highway Commission, a survey of state highway departments showed that the national average is eight professional engineers per million dollars of construction in planning, design and supervision.

In 1954, Wisconsin's 400 engineers placed $423 million worth of construction—10 engineers per million. But in 1955 the same 400 engineers worked on $73 million worth of road construction, and in 1956, the same staff is estimated to have placed $100 million. That brings the number of engineers per million dollars down to four.

Plummer claims no magic in the accomplishment—the realignment of professional-level personnel gets a large share of the credit—but the fact is, Wisconsin has used only some of the methods discussed here.

The Texas State Highway Department, by adopting photographic reproduction of pencilled plans on paper—and on cloth for more permanent sets—and by embracing other manpower savers decreased by three months the time required to prepare 260 sheets for a 3-mi federal-aid project with numerous structures.

The department estimated a saving of 40% in technical manhours over ordinary plan preparation and 60% reduction in engineering cost on this item alone.

Robley Winfrey, Bureau of Public Roads chief of personnel and training, sums up the personnel problem with a plea that the engineer devote the same amount of will and energy to proper utilization of engineers as he has to utilization of machinery and equipment. "We would have the problem licked, permanently," he comments.

And it is of more than passing interest that very personal human relations—often too-little considered in the past years—have a most important effect on productivity of an engineering staff. Such matters as air conditioning for the comfort of the staff; of "coffee breaks" to interrupt the often monotonous processes inherent in the job; of good lighting, some attempt at provision of comfortable working areas and pleasant surroundings can do a great deal toward improving the morale—and hence the work—of a staff.

In this same line, many engineering organizations have found it profitable to pay attention to group health and accident policies for the staff; pension or severance pay provisions; and some real attempt to provide for continuity of employment to combat the young engineer's constant feeling that quite often, by being diligent, he is quite literally working himself out of a job.

Engineering employers have special problems in this regard, due to the inherently varying demands of their work. But many have succeeded, nevertheless, in working out satisfactory answers.

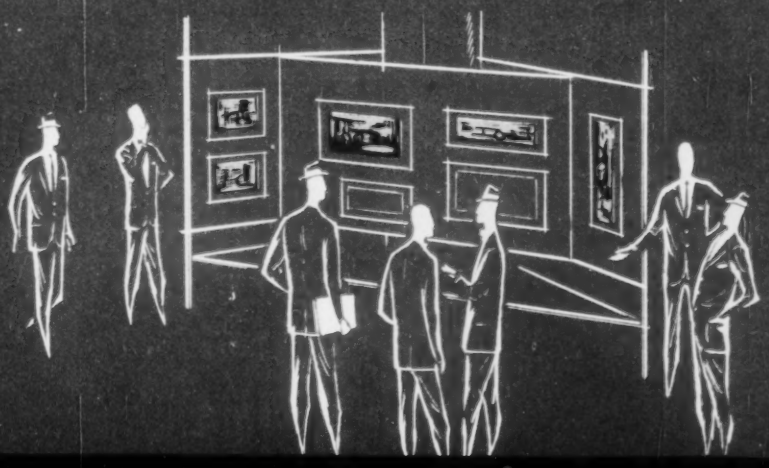
Road Show Highlights:

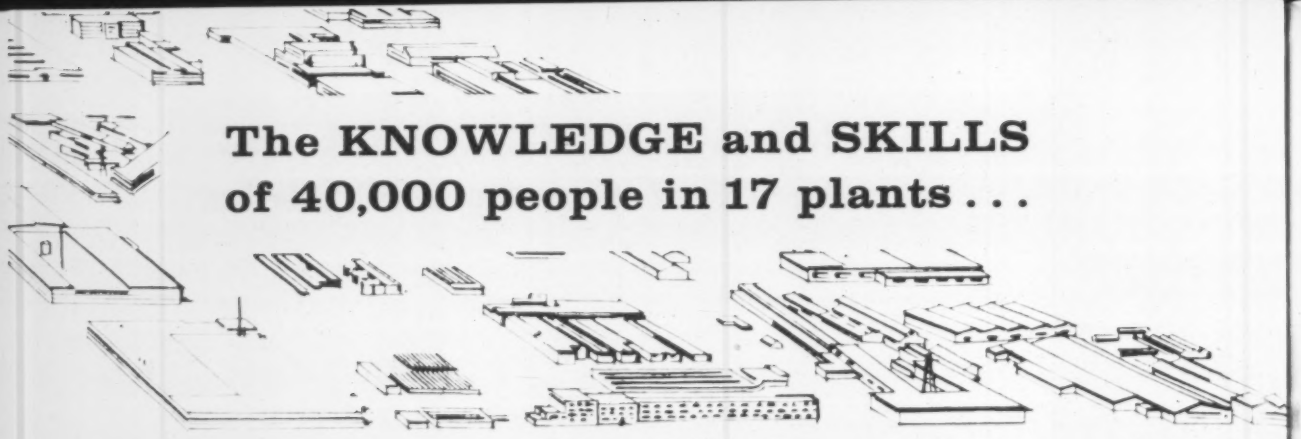
See how

ALLIS-CHALMERS

Engineering-in-Action

can help you meet the challenge of the big road-building years ahead!





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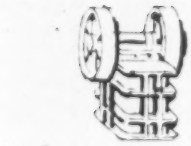

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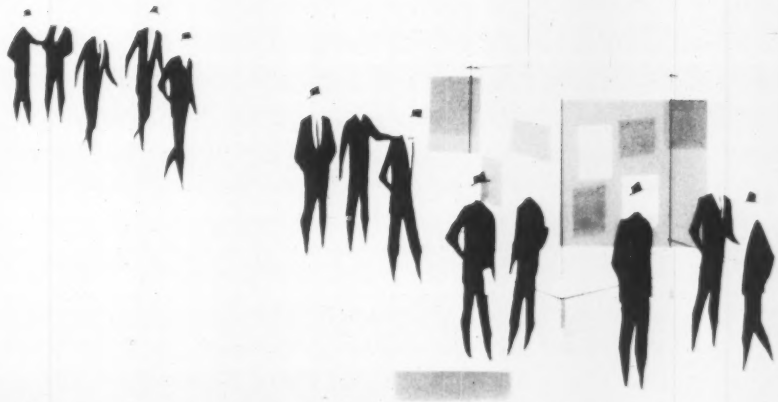

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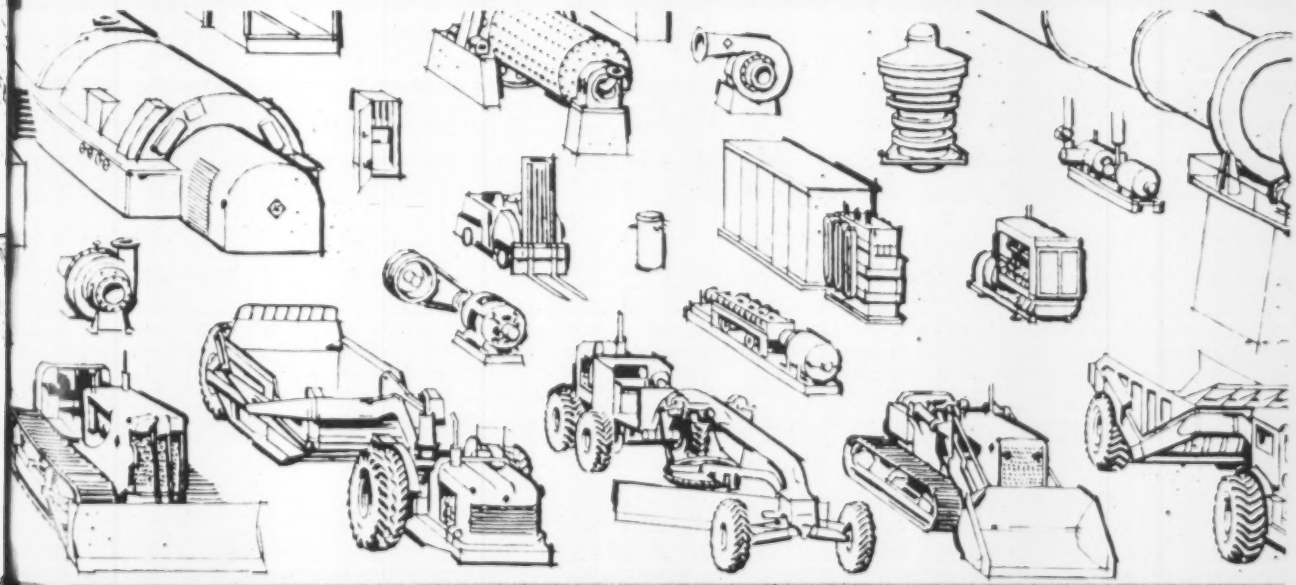
basic products for the world's major industries . . .



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production and profit on the job!

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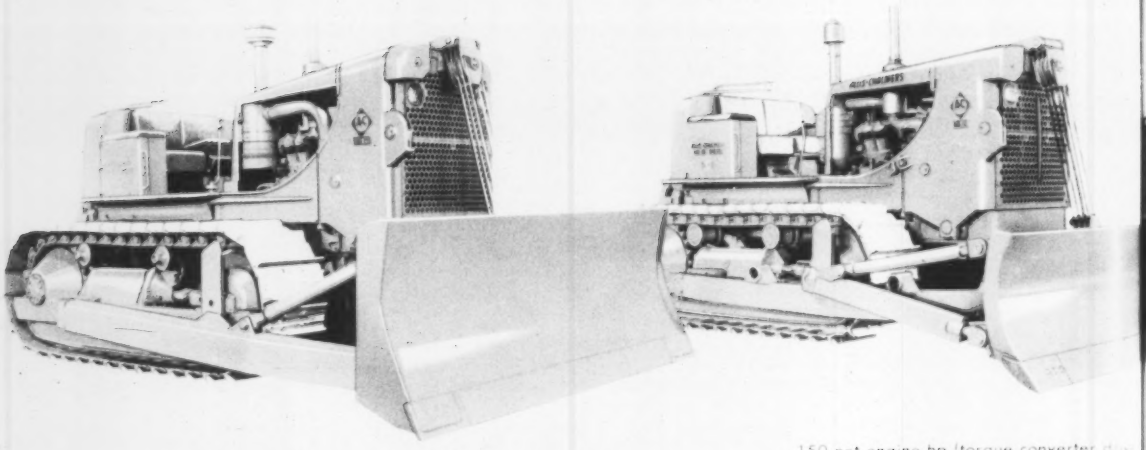
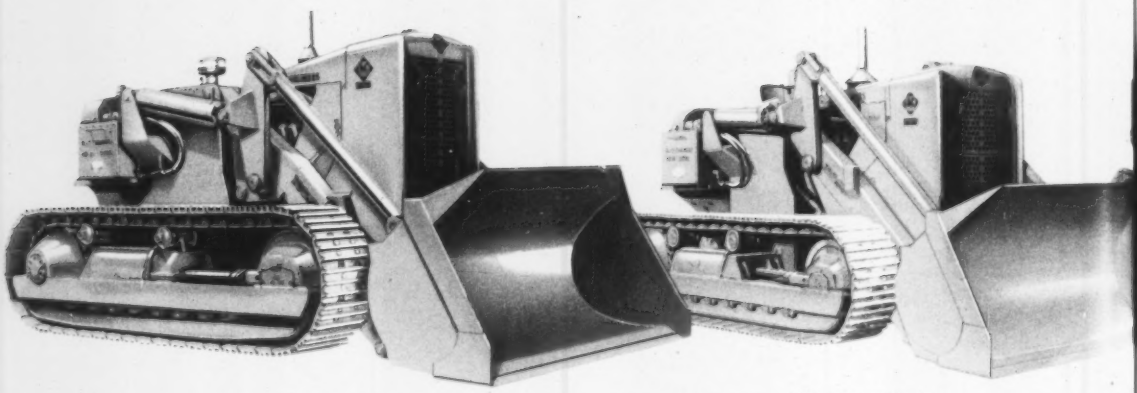


HD-21 204 net engine hp
(torque converter drive)
2 forward speeds to 7.5 mph
1 reverse speed to 5.5 mph
53,400 lb (approx. as shown)

HD-16 150 net engine hp (torque converter dri
3 forward speeds to 7.2 mph
2 reverse speeds to 5.5 mph
141 belt hp (standard transmission)
6 forward speeds to 5.8 mph
3 reverse speeds to 4.5 mph
38,200 lb (approx. as shown)

HD



4-cu-yd HD-21G 204 net engine hp
(torque converter drive)
13-ft, 4-in. dump height
66,500 lb

3-cu-yd HD-16G 150 net engine hp
(torque converter drive)
12-ft, 3-in. dump height
47,800 lb

2

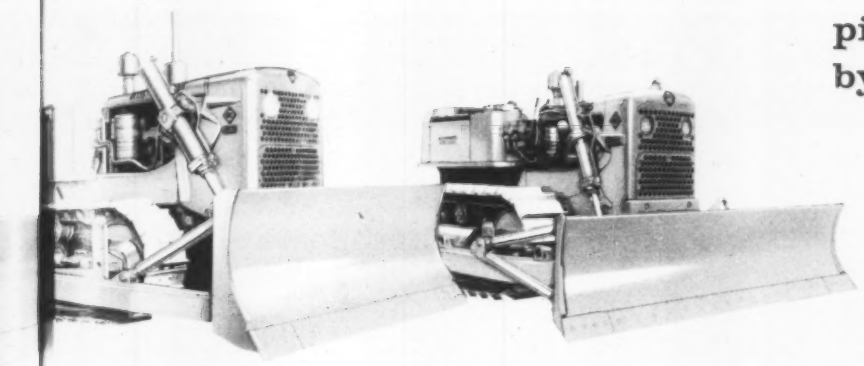
HD

Model 315 Struck 15 yd
Heaped 20 yd
Cable control
25,850 lb

Model 108 Struck 8.4 yd
Heaped 11 yd
Cable control
15,250 lb

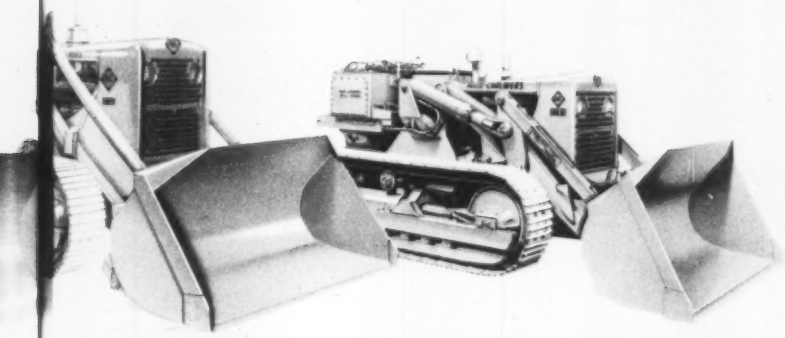
Mod

PRODUCTION AND PROFIT ON THE JOB



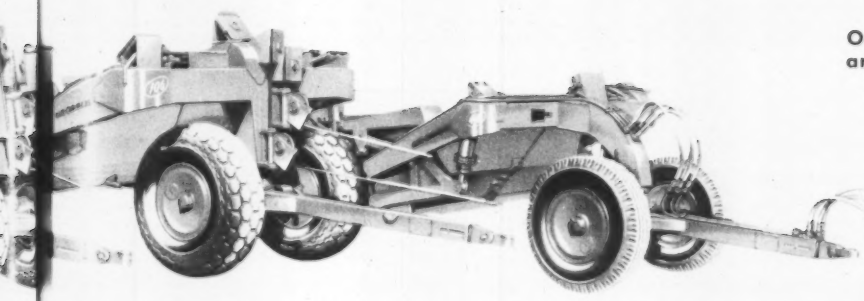
HD-11 94 belt hp
6 forward speeds to 5.7 mph
3 reverse speeds to 4.4 mph
24,600 lb (approx. as shown)

HD-6 63 belt hp
5 forward speeds to 5.5 mph
1 reverse speed to 2.0 mph
15,850 lb (approx. as shown)



2 ½-cu-yd 111 net engine hp
11-ft, 7-in. dump height
HD-11G 32,000 lb

1½-cu-yd 72 net engine hp
10-ft dump height
HD-6G 19,600 lb

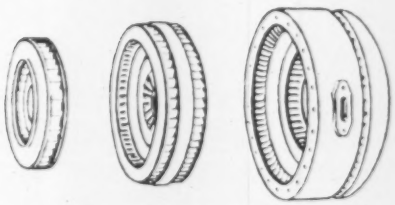


Model 106 Struck—6.1 yd
Heaped—7.5 yd
Cable control
10,300 lb

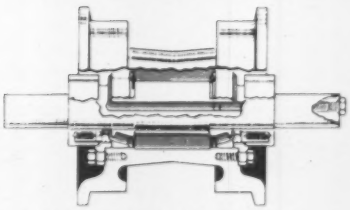
Model 44 Struck—4 yd
Heaped—4.7 yd
Hydraulic control
6,595 lb

Examples of Engineering in Action

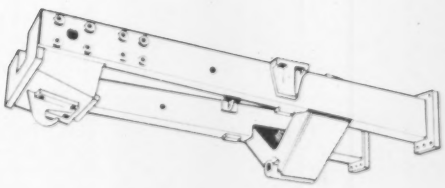
ADVANTAGES pioneered and proved by Allis-Chalmers



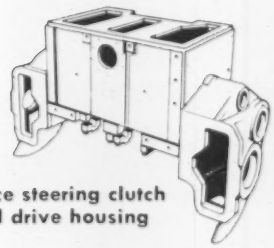
Torque converter drive



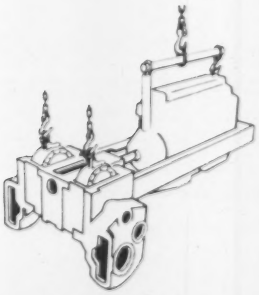
1,000-hour lubrication intervals



All-steel Box-A main frame

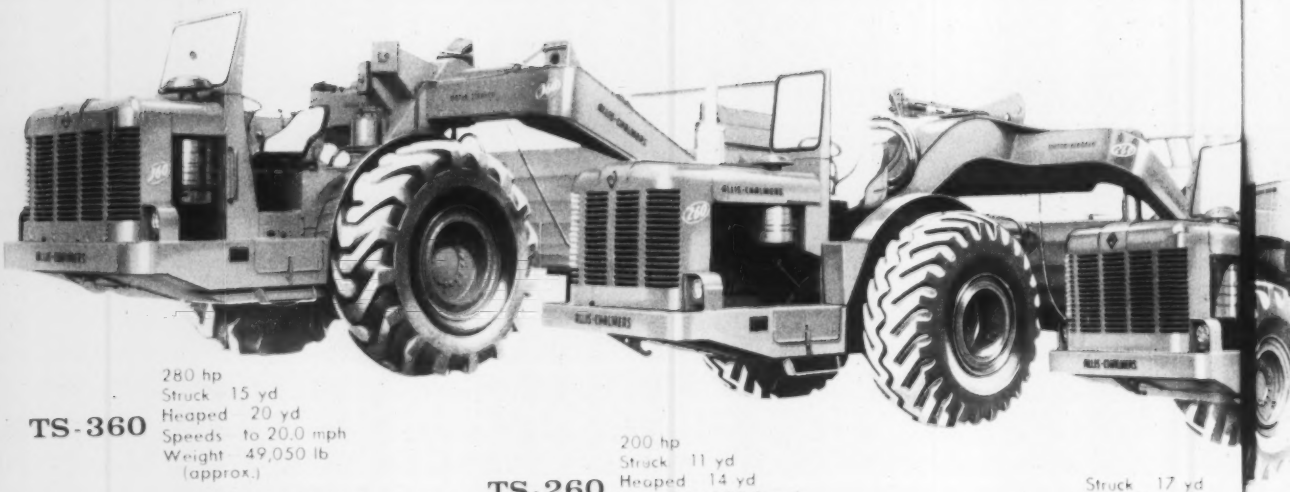


One-piece steering clutch and final drive housing



Unit construction

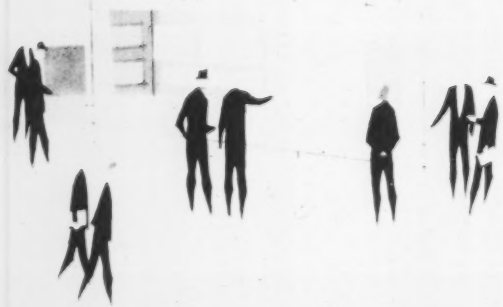
Engineering-in-Action



TS-360
280 hp
Struck 15 yd
Heaped 20 yd
Speeds to 20.0 mph
Weight 49,050 lb (approx.)

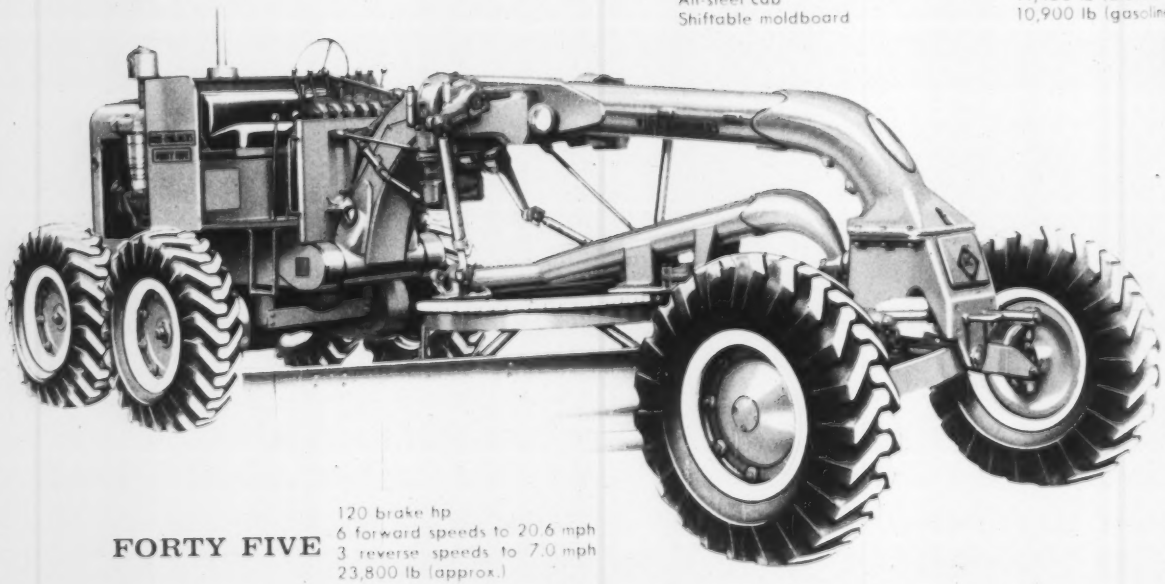
TS-260
200 hp
Struck 11 yd
Heaped 14 yd
Speeds to 20.0 mph
Weight 39,600 lb (approx.)

TW-360
Struck 17 yd
Heaped 22 yd
Tons 26
Weight 47,000 (approx.)



Model D Special

50 brake hp, gasoline or diesel engine
4 forward speeds to 25 mph (approx.)
1 reverse speed to 3 mph (approx.)
All-steel cab
Shiftable moldboard
Hydraulic scarifier
Leaning front wheel
Power circle turn
11,450 lb (diesel)
10,900 lb (gasoline)

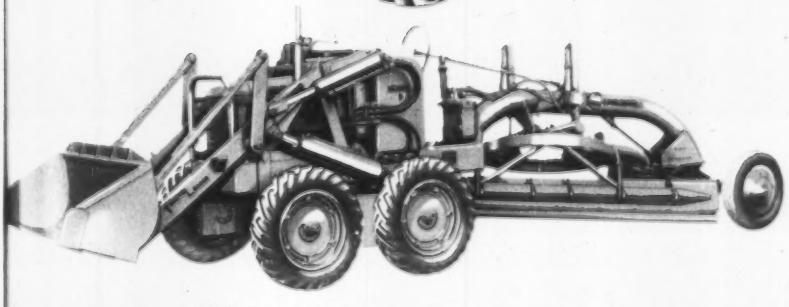


FORTY FIVE
120 brake hp
6 forward speeds to 20.6 mph
3 reverse speeds to 7.0 mph
23,800 lb (approx.)

DUCTION AND PROFIT ON THE JOB

TR-260

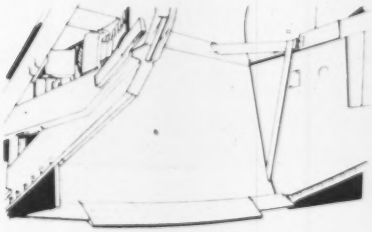
Struck 11 yd
Heaped 15 yd
Tons 18
Weight 43,800 lb (approx.)



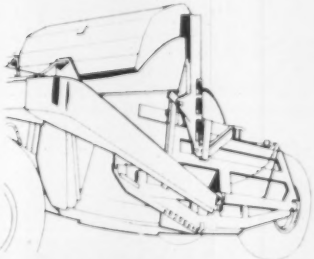
Model D Standard and **ar-End Loader**

8,800 lb (gasoline)
9,350 lb (diesel)
¾-cu-yd bucket
hydraulically controlled
Loader 2,200 lb (approx.)

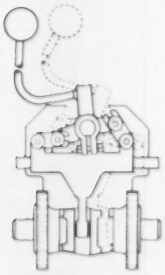
Examples of Engineering in Action ADVANTAGES pioneered and proved by Allis-Chalmers



Curved bowl bottom and offset cutting edge

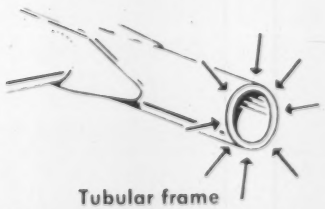


High apron lift and positive ejection



Toggle-type control

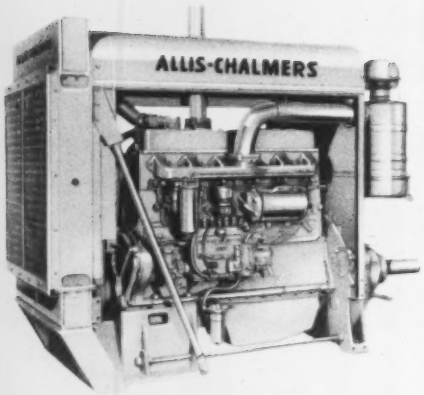
ROLL-AWAY moldboard



Tubular frame

Engineering-in-Actio

FOR PRODUCTION AND PROFIT ON THE JOI



Power Units

D-153 Diesel
35 max. brake hp @ 1800 rpm

D-230 Diesel
53 max. brake hp @ 1800 rpm

B-125 Gasoline
28 max. brake hp @ 1800 rpm

D-779 Diesel
160 max. brake hp @ 1800 rpm

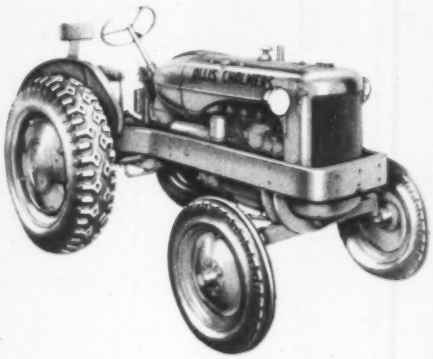
D-844 Diesel
189 max. brake hp @ 1800 rpm

DS-844 Diesel
243 max. brake hp @ 1[illegible]

Wheel Tractors

Model IB
22.87 belt hp

Model WD-45
45 belt hp



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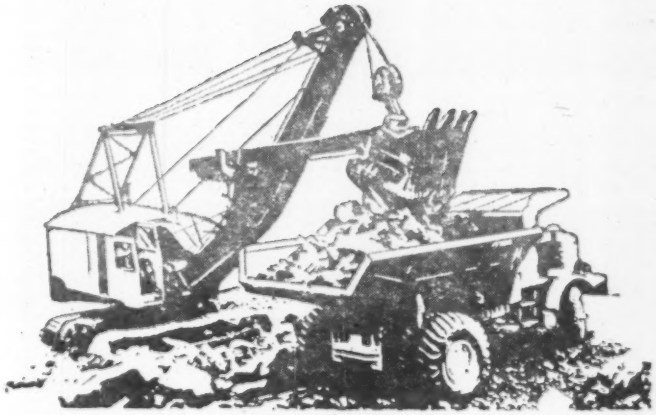


A staff report by
the editors of Engineering News-Record and
Construction Methods and Equipment

TOOLS OF THE ROADBUILDER

- *What's available*
- *What they can do*
- *How they have developed*
- *Where they are going*

FROM FIRST SURVEY PARTY . . .

TO FINISHED SUPERHIGHWAY . . .

Behind the Road Program—the

UNDERLYING the planning, the spending and the hopes for the great new $33 billion interstate highway program—and for the $70 billion or more of total road expenditures foreseen over the next 13 years—is one cardinal fact:

The whole program is possible within the time and for the price largely because of the fantastic capacity, versatility, and availability of the machinery now being put into the hands of U. S. contractors.

It would seem that no recital of the advances in machinery is necessary—the horse-drawn Fresno scraper is within easy recall of many of the readers of these pages—but the story is so tremendous in its scope, so much a matter of pride to the construction industry, and so full of consequences bearing on future progress, that no amount of retelling can overdo it.

Even such an equipment display as the forthcoming Road Show in Chicago doesn't bring out the full meaning—presenting, rather, the conclusions in terms of the spectacular machines that are typically American combinations of ingenuity, research, and manufacturing skills.

How these machines came to be, what they can do, and what will develop from them forms the significant background. This is the story that is told in the pages that follow.

Big and getting bigger

Much-overworked words like "huge", "mammoth", "tremendous" come easily to the tongue when one talks about construction machinery—and the words in this case are not improper. In fact, they're not descriptive enough, for:

Machines so enormous they can pick up the equivalent in volume of a small house; machines that can lift tons of material over a hundred feet into the air and place them delicately where men want them to be; machines that,

. . . TAKES A LOT OF THIS

Machines That Make It Possible

working together, can take in, chew up and treat raw materials and spew out finished roads; tires so huge that a single one could supply all of the rubber needed for all of the tires of eight ordinary pleasure cars; or machines with an uncanny, animal-like vitality of their own, capable of making three or four different movements at the same time. These are the kind of machines that today's constructor men accept as their due.

From the Fresno—with its quite literal 1 or 2 hp —to the monstrous carrying scrapers of today, drawn by nearly 500 hp and with capacities to 43 cu yd at a bite—the machines have been getting bigger. And they'll get bigger yet.

The reason is a typically American one: The job gets bigger all the time. Equipment and labor prices have tripled in the last decade, but the price of moving dirt has remained very nearly the same. With a highway program such as has been staked out, earthmoving will amount to the billions of cubic yards; structures into the hundreds of thousands. And machines must be built so that more work can be done per man.

Moreover, the new roads will often be built not where nature has provided the best possible conditions of terrain and subsoil, but in places where men want them to be for their own convenience. When nature isn't cooperative, it must be shaped to conform.

Specialized and versatile

But in the midst of the trend to bigness in the machines, there are other requirements that also must be satisfied.

In many of the earthmovers and paving equipment, the growth in size—and cost—of the machine has made it more and more a specialized tool. A scraper that can load 50 or more cubic yards at a time; a crane that can lift

150 tons; a belt-loader that can move 12,000 cu yd in an 8-hr shift; a dump body that can carry 50 cu yd; a batching and mixing plant that can turn out hundreds of cubic yards of concrete an hour—these are expensive, and require special working conditions and huge production schedules for efficient use.

In contrast to these, then, two of the tools in particular emphasize something else besides size and power: versatility.

The tractor—on rubber or crawlers—that can be a dozer, a prime mover, a crane, a backhoe, a front-end loader, a pipelayer, a shovel—is one of these machines. The other is the mobile crane—also either on rubber or crawlers—that can be a shovel, a crane, a materials handling unit, a pile-driver, a backhoe. These are machines that a contractor gives no rest—and that he draws on for greatest use.

Concurrently, too, there has been considerable development of very small machines—most of them also special-purpose. Tiny rollers, almost miniscule loaders and tractors, tampers and the like have been coming out of the factories for special small jobs like paving shoulders, drives, making curbs, getting into and out of restricted working areas. The motorized buggy is also one of these new small machines, but with a big as well as small job potential.

Prime developments

But with all this, there are perhaps six major points of development within the machines themselves, which should be kept in mind by the visitor to the road show and the user of the machines. For from them, either singly or in combination, have flowed most of the innovations in size, capacity and versatility.

A tabulation, not necessarily in order of importance, would run this way:

1. Rubber tires. The developments in the composition of the tires themselves—including the use of synthetics for greater strength and heat resistance—their durability, flotation, tractive power, have added 20 to 30 mph to the speed of construction haulage, and increased immeasurably the maneuverability and transportability of the machines.

2. Metals. Methods of hardening and treating metals, to improve them both for use within the engine and its moving parts, have almost eliminated such problems as stripped gears and greatly increased the usability of the power. Bucket teeth, loader edges, drill steels have also benefited.

3. Lubricants. Improvements in greases and oils—and fuels as well—which have eliminated the need for dozens of different grades and kinds of lubricants for various moving parts, have cut maintenance problems for the contractor, lengthened the life of the machines.

4. The torque-converter. This device for increasing the twisting power of the engine has provided the answer to two important needs: To get more power out of the engine without increasing its size; to get smooth application of power to deal with varying loads; to make it difficult for an unskilled operator to apply damaging shock loads to the machine. In effect a super hydraulic drive, the torque converter has reduced the number of wearing parts, and drastically cut down the number of controls.

5. Operator comfort and convenience. Despite its power and capacity, no machine runs better than its operator "tells" it to. And the machines were getting beyond the operator's physical capacities—control levers, buttons and pedals multiplied too fast for a man to work them efficiently and smoothly. The trend is now toward simplification of controls (made possible in part by the torque converter and automatic transmissions in parts), until one huge shovel loader, for instance, is controlled only by a front-back lever, foot throttle, brakes, and two levers to control lifting and digging actions. Emphasis is also being placed on visibility, comfort of the seat, protection from weather and dust.

6. Serviceability. More and more, the machines are being produced with fewer and fewer grease cups, oiling points and the like—more and more the trend is toward sealed units that require no field servicing at all. Another trend is toward making replacement parts that can be installed in only one way—with no possibility of wrong assemblies.

There are many other points that could be added: Improvements in the engines to produce greater and greater power—and the search right now for a full turbine engine that would raise the power ratings greatly without increasing size and weight; improved manufacturing techniques that permit ever closer tolerances, finer finishing and machining.

Availability

On the point of availability, there seems to be no worry.

Admittedly, the $33 billion part of the highway program will require a lot of machinery—estimates run to about $3 billion worth within the first four years of the program, and more beyond that time.

But no manufacturer feels that he won't be able to supply that demand or any other that materializes. Most started nearly two years ago to gear themselves for the demands of such a huge construction program. Several firms that weren't even in the field of construction machinery have recently entered it—and with both feet and plenty of money and knowhow.

Such demands for new equipment will also increase the demand for money—or credit—with which to buy. And still another facet of the construction industry—banks and credit organizations—is mobilizing to fill this need. There seems no doubt that both the machines and the money will be available.

Management

With the bigger and better machines has come another problem for contractors: Management.

If the efficiency of the machine is a function of the efficiency of the operator, then the operator's efficiency is a function of the efficiency of management. Proper scheduling of trucks to a big loader; good organization of haul roads and distances; best utilization of the machine is an increasing problem for managers, to insure that their investment in men and machines is profitable.

Many agencies, public and private, have been studying the problem. Such minute matters as the difference, in seconds, between greater and smaller arcs of swing for a shovel; in minutes for delays while an operator gets out to stretch his legs, or waits for a pusher to maneuver behind his scraper, or waits for a truck to come within the loading area, are of major importance in terms of money and production.

In sum

But in the end, the machines that are in use and that will come are a tribute to the contractor.

His needs, his ingenuity are the drive behind it all. Most manufacturers keep teams of engineers in the field throughout the year—just to see what new and unorthodox things the contractors are doing with their machinery. And many of these job-made adjustments become standard parts of the machines.

The contractor has much to be proud of. Much to look forward to. The pages that follow give in detail some of what's been done, and what's to come.

Then—Underpowered, small capacity dump body was tilted by hand winch, but real advance in early 1920's.

Now—Diesel powered rear dump rock body carrying loads to 30 tons, symbolizes advances.

Haulage Units . . .

Bigger, More Versatile

Some means of moving materials from one place to another—efficiently and in ever greater quantities—has always been a prime concern of the contractor. Two methods have offered themselves from early times: a wagon, drawn by some outside power source (human, animal and mechanical in that historical order), and a self-propelled one-unit machine—a truck.

(Since about the early 1930's there has been still another means—the self-loading or carrying scraper. But that development, sometimes called the greatest single development in earth-moving practice, must be treated as a separate story, and is so treated in another part of this section.)

The essential part of a materials-moving contraption have never changed. Some sort of a box that can be loaded with relative ease, be pushed or pulled or carried to a destination, and unloaded. There's nothing new about methods of unloading—horse-drawn wagons even in the earliest times could be unloaded by tilting, "bottom-dumped" by simply removing a few or all of the boards that made up the bed of the box, or by pushing out the contents through a removable tailgate.

What has changed, though, about such equipment is important. Motive power, the wheels on which the machines run, the materials of which they are made. It is difficult to put these three developments into any order of importance—they are interrelated so closely in the development of the huge and

REAR DUMP WAGON combines ejector mechanism with rock body for precision dumping, spreading on the run.

efficient haulers of today and those of the future.

With better steels and manufacturing techniques, carrying of all manner of heavy and abrasive loads is easy; with the great improvement of rubber tires, increases in speed and tractive power are possible; with the improvement of engines,—which has brought up to 600 hp into use for this purpose; and with improvement of driving mechanisms, power trains and the like, the contractor has at his command unparalled power to do his bidding.

Pull, push, or carry?

Just how best to move the load is a matter of some debate,—there are advocates of pulling as in a wagon, and of carrying as in a truck.

First attempts were always by carrying of course, in hods or baskets. Then with the advent of the wheel, and later of animal power, heavier loads could be pulled. With a practical internal combustion engine, in the early days of the present century, however, the wagons began to disappear from construction work, the truck became king of haulers.

Lately, though, the wagon has reappeared in the form of a huge box this time, with capacities near 40 cu yd, pulled by powerful tractors ranging into the 400 hp class.

The question of which method to use resolves itself into the requirement of the particular job to be done.

Generally, the truck gets the nod for heavy rock work, for steep grades, or where traction is poor. The big off-the-road trucks, with their multi-axle drives, articulated bogies, get better traction since most of their weight is on the driving axles. And if space around the loading shovel is limited—as it most often is in deep cuts—the truck has the easiest time getting in and getting out.

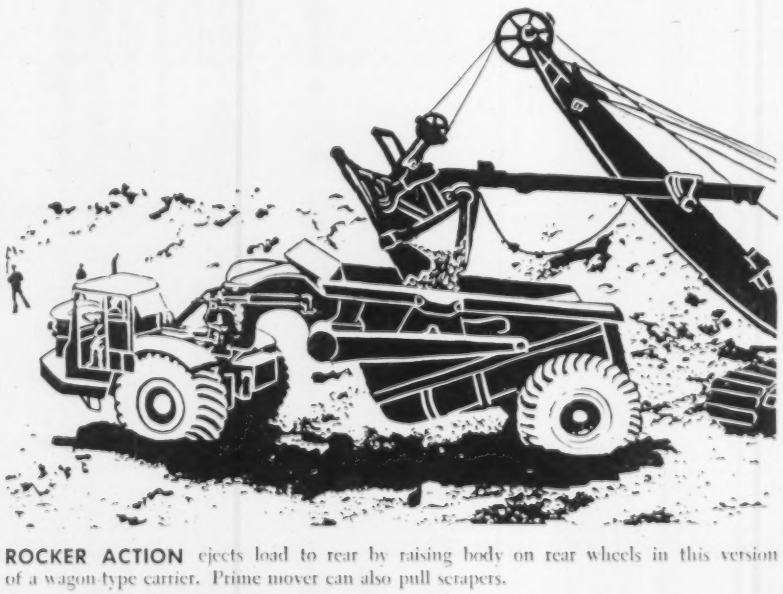
Bottom-dump wagons pay off best in softer materials, on flatter terrain, and where haul roads are relatively good or traction satisfactory. They can carry huge loads, float over new fill, can discharge "on the run", and work especially well in big borrow pits, either under shovels or belt-type loaders.

The end-dump wagons are also useful on many types of work: They can handle well-broken rock, maneuver in tight quarters, climb medium grades, and dump quickly and safely. There's a further advantage—the end dumps can be used with the prime movers that pull scrapers.

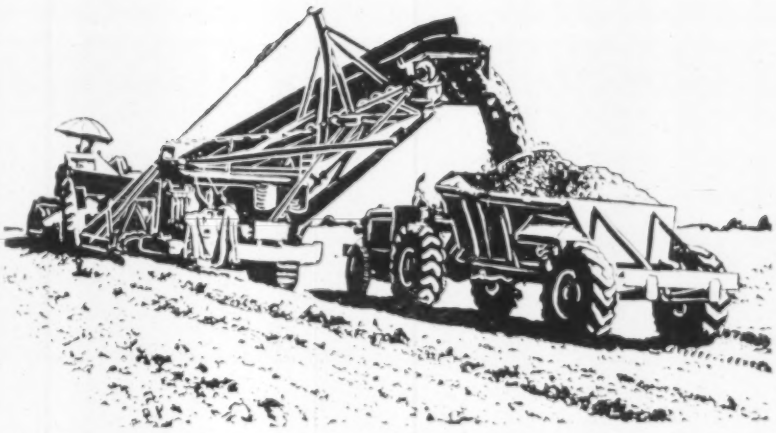
And a new type of haulage equipment, introduced recently, combines the characteristics of end-dump and bottom-dump wagons. The body can handle rough material, and it has the added advantage of an ejector mechanism that can spread the load on the run.

The trucks have an advantage, at the moment, in that they are most often transportable (if stripped down, in some instances) over the road to the next job. The wagons—principally because of their width, rather than weight—are difficult to move under their own power over standard highways. But contractors have been increasing over-the-road transport of the wagons and scrapers (at the cost of special permits from communities and states) and there are now several organizations available that do nothing but transport these machines from job to job.

In on-highway trucks, the trend is also to bigger units, with multiple drive axles—the popular sizes being 10 to 15 yd dumpers. Semi-trailers also are popular machines, particularly for hauling aggregates, bulk cement and other items. Like their off-the-road brothers, these units feature power steering, power braking, automatic transmissions with up to six speeds for extra pulling power.



ROCKER ACTION ejects load to rear by raising body on rear wheels in this version of a wagon-type carrier. Prime mover can also pull scrapers.



BOTTOM DUMP (belly dump) wagons work best with soft material, can discharge on the run, carry huge loads. Towed belt loader speeds operation.

And in the same field, the ever-present four-wheel drive cars and pick-up trucks that can negotiate the roughest terrain, are becoming most popular as job workhorses and personnel carriers.

What kind of service

Greatly improved manufacturing and engineering techniques have now developed rugged metals and rugged designs so that both the wagons and trucks can carry a variety of materials.

In addition, many special-purpose body types are coming out of the factories—built to handle materials for spreading of surfacing materials, for handling and unloading hot-mix and cold asphalt, for carrying concrete considerable distances, either dry or already mixed. Many of these can be used on standard chassis, some require their own special setup. Other attachments permit trucks to load themselves or other vehicles, serve as light-duty graders or material-spreaders.

Separately, the manufacturers of ready-mix equipment have been carrying on their own developments—most of them looking to ever-larger capacities, more complete control of mixing and unloading.

And another very special class of haulage equipment is the trailer, which transports other pieces of construction machinery (such as track-type tractors) from one job to another. Again, with the emphasis on speed and mobility, many of these are virtually self-loading, requiring no ramps or other special attachments. Some simply tilt down to form a ramp for the machine to be transported, then tilt back to roadable level when the load is properly placed.

Gasoline or diesel?

Eight years ago—at the last road show—there was considerable evidence of real competition between gasoline and diesel engines for the position of favorite for motive power.

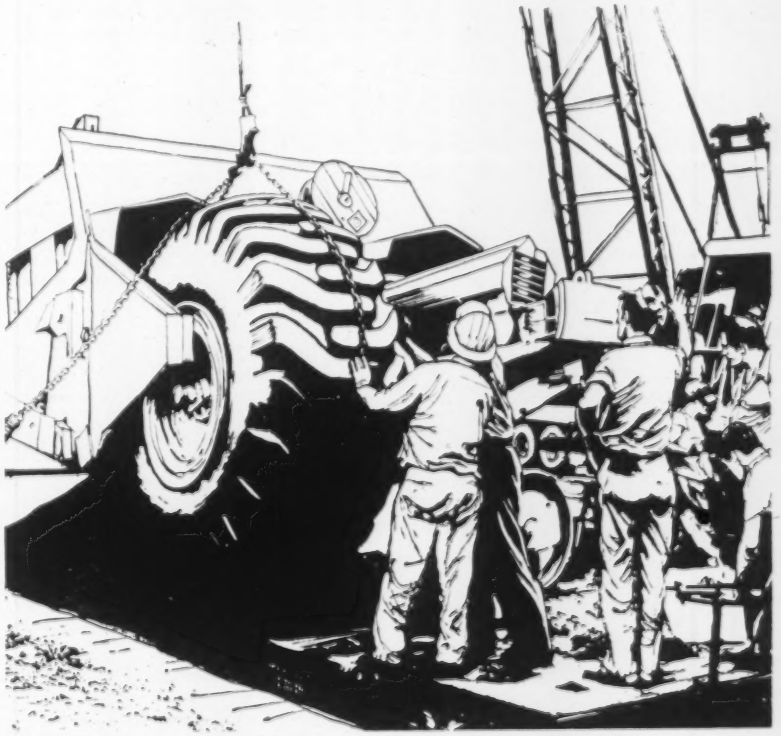
As of today, it's probably a fair statement that the gasoline engine continues to hold its own, particularly in smaller truck models (up to about 4 yd capacity), on the basis of manufacturing economies, quick starting in cold weather. In very powerful engines, however—165 hp and up to 600 hp—the diesel is virtually alone. And diesel manufacturers have developed and are improving quick starters of their own.

The Torque Converter

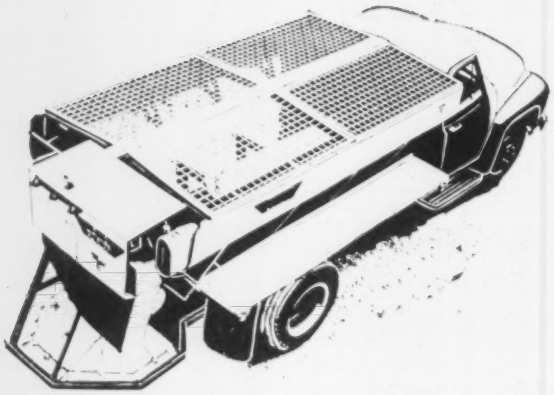
With the improvement in the efficiency of the engines—itself a function of better manufacturing techniques and better metals—have come a host of related improvements.

Chief among these improvements is the torque converter, which is, in effect, a super hydraulic drive quite similar to those on most present day pleasure cars. It takes power from the engine drive-shaft to a finned impeller, which imparts a swirling motion to a liquid. The liquid in turn drives other impellers and gearing that connect with the power train, taking the power to the driving wheels of the machine.

This eliminates the need for the many controls and parts that form the more conventional mechanical clutching system—a series of plates or gears that must be lifted in and out of contact with each other. Loss of torque, or twisting power, of the engine is less at low speeds with this system than with a mechanical clutch, and an increase



RUBBER TIRES in ever larger sizes are one principal key to the speed up and increased capacity of all haulage equipment, most other construction machinery.



SPECIAL BODIES like this one, to spread salt and surfacing material, are available for standard truck chassis.

in tractive effort is possible simply by increasing the speed of the engine through a foot or hand throttle.

Several manufacturers are now putting out models with two torque-converters, each driving an individual rear wheel, to get even more power without the added losses inherent in the more conventional rear-axle differential gears.

Other improvements in the driving train included improved two, four, and six-axle drives, articulated axles to permit shorter turning radii, suspension systems that permit the wheels to ride over nearly any obstruction without disturbing the load. Considerable engineering attention is going into the problem of reduction gearing—means of reducing engine speeds of upward of 2,000 rpm to 30 or 40 rpm at the wheels. Power steering and power braking have become nearly standard equipment—and contributed a large share to making the huge present-day machines practical possibilities.

Within the engine itself, turbo-superchargers have been added to increase horsepower without too much added size and weight; power takeoffs are available to connect a variety of related equipment; hydraulic cylinders to ease operation.

Tires

As for all forms of mobile equipment, the amazing development of the tires themselves is a major part of the improvement in haulage equipment.

In the opinion of experts you can put the development of tires into three key words: Nylon, wide-base, and tubeless.

Earliest earthmover and construction truck pneumatic tires were made in the mid 30's with cotton cord. But increasing speeds and consequent heat-buildup were responsible for many failures,—structural breakdown or heat blowouts.

Rayon, during the period 1938-1953, provided a partial answer, due to its greater strength and resistance to heat; steel mesh has also been used.

But Nylon—coming into the picture in aircraft tires during World War II,—provided the real answer. It had greater strength than either rayon or cotton, greater heat resistance, and was light in weight so that tires themselves could be made stronger with less thickness, could be more easily recapped and were more resistant to wear and cutting in the rough usage that's common on construction jobs.

As to the wider base: Standard practice in tires design has long been to use a rim about 70% as wide as the tires. New designs increase this ratio to about 85%. This permits putting within the tire casing a greater volume of air for any given diameter, so that a given load can be adequately supported at lower pressure than possible with the narrower rims.

Other results of the wider base are better flotation of the load, so that tires can get through poorer ground than could the harder, older tires; provide better traction because of greater area on the ground (as well as because of improved tread designs).

Tubeless designs—introduced only about two years ago—required a change of major proportions on heavy trucks and earthmovers, which had as many as five parts to their old-style rims. The new tires eliminated the tube and flap troubles that were said to be responsible for nearly 90% of the downtime due to tire repairs. In addition, the tubeless tires run more smoothly and with less heat; and are more easily mounted.

For the Future

In motive power, it appears that horsepower won't be increased too much—at least pending the development of a full turbine engine. But lighter and better metals, improved superchargers and turbochargers, better and simpler drive systems, promise more power per pound of engine.

As to the full turbine engine, there's a considerable debate raging over it now. Several manufacturers are experimenting with it, small ones have been built for stationary engines, a couple are now in use on pleasure-car prototypes. For construction, however, the objections seem to rest on two points: A full turbine "eats" a lot of air—and the air must be clean. The problem of cleaning it on a construction site is a serious one. The other objection is the problem of gearing down the 18,000 or so rpm of a turbine to the 30 or 40 rpm of the wheels—and with the added problem that a turbine cannot be "idled" at slower speeds.

On tires, the newest, and as yet largely untried, development is the "barrel" type—a huge rubber bag that completely surrounds the axle from end to end. Great things are claimed for the tire. It can be powered by any conventional drive, its immense tread (full width of the chassis) gives it excellent traction and flotation, low pressures make it ride easily over most obstructions.

On trucks, bigger and bigger sizes are coming out of the factories—up to the 50-ton range; wagons are getting just as big—now on the boards are plans for a 50-yard wagon. But the limiting size requirements of even occasional operation on public highways seems to be a factor holding the size of most trucks to about their present proportions.

In all types of equipment, the trend toward simplification of controls for the operator is being boosted mightily by the new drive-trains and hydraulic and electrical "booster" equipment. Push-button operation isn't far in the future for most haulers.

And with this development is going simplification in service requirements. More and more parts of the engine and drive machinery are being made as sealed units that require no field servicing at all; numbers of greasing and oiling points are being reduced, and grouped for easy reach and to be out of the path of dirt; improvements in lubricants have cut down the number needed from as many as 23 to just three—and one manufacturer is even toying with the idea of using the same lubricant in the engine as in the hydraulic system.

Then—Steam shovel with half-yard bucket could keep line of wagons busy.

Now—Power shovel carrying 3-5 yd bucket, lifts bigger loads, keeps trucks rolling.

Shovels and Cranes

Handymen for Contractors

Second only to the tractor as the most versatile big-capacity tool available to the construction industry is the power shovel or crane. In practically all sizes, these machines are convertable, multi-purpose rigs, built to move enormous quantities of material fast.

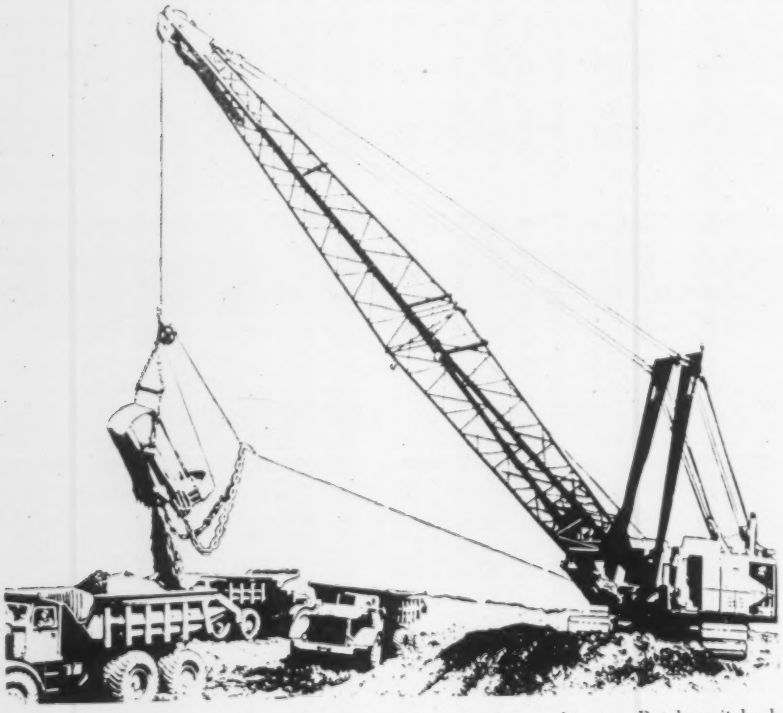
Smaller models—many of them now truck-mounted—can be converted with greater ease however from shovel to crane to backhoe, to dragline, used to move all types of materials around the job, place concrete and to do a variety of other jobs.

Following closely all other construction equipment, the demand in these machines has been for bigger and bigger capacities, coupled with greater mobility and better construction to eliminate costly repairs and downtime and to increase operating efficiency.

Older in concept than most other construction machinery, shovels were among the first pieces of equipment manufactured for power use—steam power, that is—and it is significant that steam power served long and well enough to establish the name "steam shovel" for almost every type of boom excavator in the public mind. First models, however, were either rail-mounted or on skids and had to be hauled from place to place by other motive power.

It wasn't until 1914, in fact, that Henry Harnischfeger brought out the first gasoline-engine powered excavator. But from that day onward, the "steam" shovel was doomed. Only in the field of pile driving rigs, were all-steam driven machines manufactured until about 1951 (although some of these are still operating).

A list of basic improvements over the years in the boom-type machines would run about this way: adding of track-type crawlers, which freed the machines of the need of being towed or pushed at



DRAGLINE, with its big capacity, usually works in hard-to-reach areas. But here it loads truck fleet in borrow pit.

the worksite; all-welded construction, for lighter, easier to handle rigs; development of hydraulic, air and electric controls that permit faster cycles—and the ever present torque converter, for smoother, more efficient power. And in addition, the diggers have benefited by the general improvements in metal-working and manufacturing in techniques—better, longer wearing metals, closer manufacturing tolerances and the like—which contribute greatly to the life and efficiency of the rig.

No easy road

It wasn't until 1934 that the first successful crawler tracks—operated by the shovel itself—were installed and operated. That properly marks the beginning of the end of the development of flat-rimmed steel wheels and half-track-and-steel-wheel combinations.

But contractors and manufacturers soon found that the crawlers brought their own problems with them—some of which only recently have been solved through intensive design modifications on all the parts of the crawler mechanism. Clog-proof driving sprockets, non-clogging treads, relocation of chain drives were some of the answers to the maintenance problem.

And all-welded construction, now virtually standard on all machines, posed the problem of radically changed shop procedures for every manufacturer—and for the contractor who had to train his own mechanics.

Air controls, too, had been available for 25 years on the largest models—but how to bring them down in size for smaller rigs challenged engineers. They found an answer in smaller, more powerful units, and in making the air controls directly responsible to the operator's levers—rather than acting as an auxiliary to boost the operator's muscle-power. One result of the air power is speed, another and most important one is "precision feel of the load" that enables the operator to handle his machine with real delicacy and accuracy.

The torque converter, of course—with its ability to transfer the power of the engine directly to the drive mechanism without mechanical clutching—is especially adaptable to the excavators which habitually meet varying load conditions throughout their operating cycle. In addition, the cushioning effect of the converter (a much-magnified fluid drive system) reduces wear on cables and other parts.

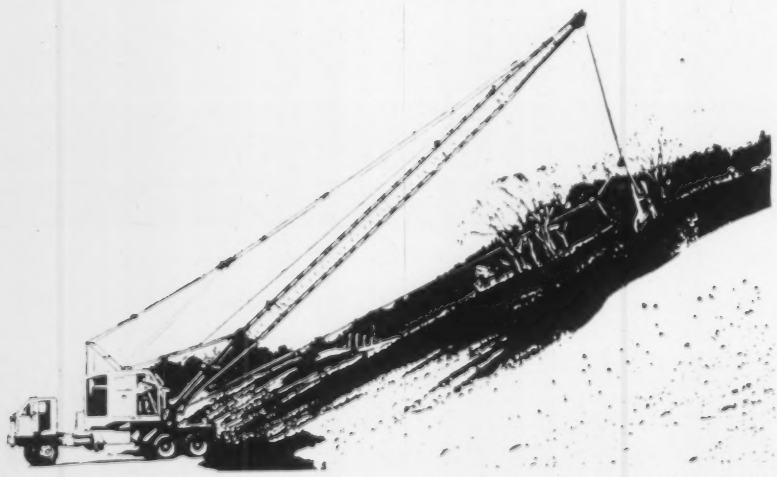
Transportability

Along with these improvements has come greater emphasis on transporting the rigs from job to job—leaving out for the moment the truck mounted units which can easily transport themselves over the road.

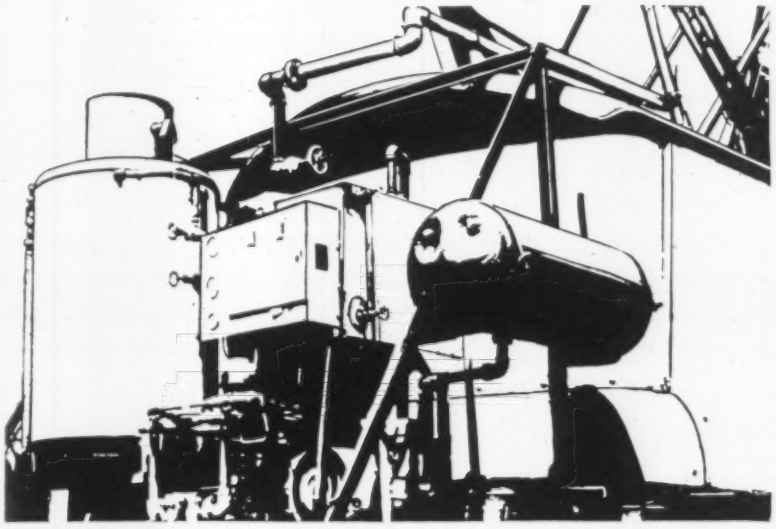
Evidence of how far the manufacturers have come in this regard should include the case of a 4 cu yd, 400 hp shovel that was recently knocked down, trucked 125 miles on five flatbed trailers, and reassembled in a total of three days. One 5¼ cu yd model now on the market, actually knocks itself down with its own mast, and can also be loaded for transport on five trailers or railroad flatcars.

The shovels

Considering these rigs as separate types, the shovels get into really out-size classes. Four big electric rigs at Oahe Dam in South Dakota, for instance, carry 13 yard buckets as shovels or 14 yd buckets as draglines, and have



SLOPE-TRIMMING is another use for standard truck crane—here converted to dragline operation on a highway job.



STEAM POWER UNIT mounted on tail of crawler crane, converts crane into self-contained pile driving rig. Steam can be developed in minutes from cold start.

moved as much as 145,000 cu yd in two 10-hour shifts.

But in more normal sizes, the demand is also for bigger capacities. For some years, the 2½ yard dipper was the biggest machine on most jobs. Today, 4 and 5 yard buckets are common.

It is interesting that for rigs above 5 cu yd in capacity, there seems to be a trend toward electric power. First cost of such units is high, but they pay off in the long run because of high production with limited downtime. One of the keys to easier maintenance for the electric machines lies in replacement of swing friction parts by electromagnetic devices which control the swing drums by sending electric current to two annular fluid coils for smooth, fast—and frictionless—swing.

On the other end of the shovel scale, there's plenty of attention to small, mobile rigs—mostly for use as backhoes, cranes, and draglines. It should be noted that the small shovel for loading trucks with loose material or from a stockpile is gradually being replaced by the tractor shovel.

The cranes

Three times in the past year, equipment manufacturers have claimed honors for the highest booms on track-mounted cranes. A boom 230 ft high—made up of a 190 ft boom and a 40 ft jib—was quickly replaced by a 200 ft boom with a 50 ft jib. And the latest claim is made for a 200 ft boom with a 50 ft jib. All three booms are of relatively light construction, using hollow-pipe-like members for lightness with strength.

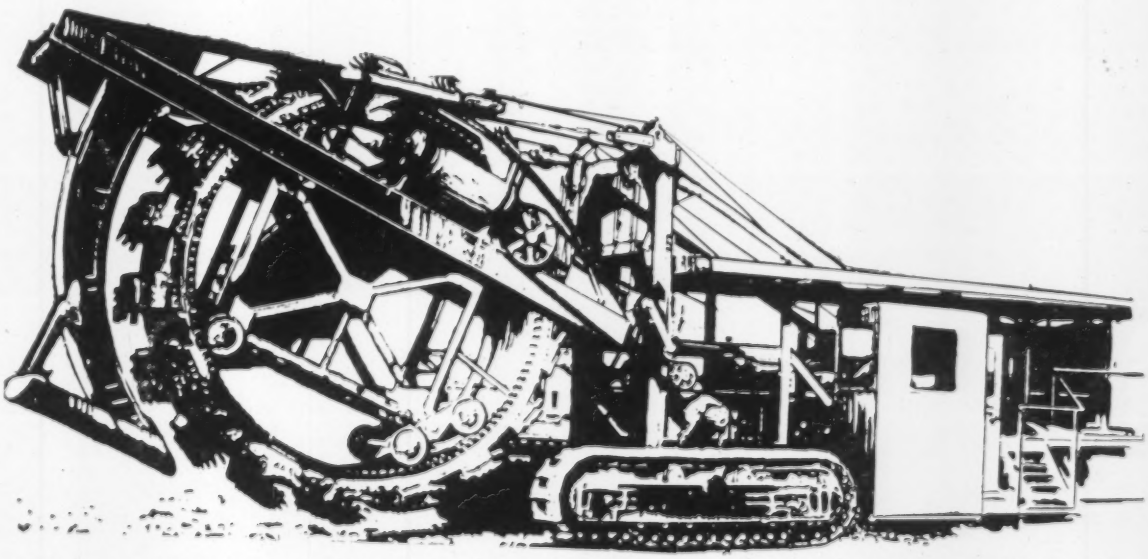
The significance, of course, isn't in how much boom a unit can carry, but in what the units can do once the boom is set. Such high booms, for instance, are given some of the credit for the increasing construction of reinforced concrete frame buildings over 16 stories high—the cranes can deliver steel or concrete for erection of structures up to 24 stories in height.

For the roadbuilder, of course, such extreme heights are seldom—if ever—necessary. But with shorter, heavier booms, and with their own mobility, the cranes he uses can erect heavy steel at considerable heights for road overpasses and bridges, lift huge concrete buckets for high pours.

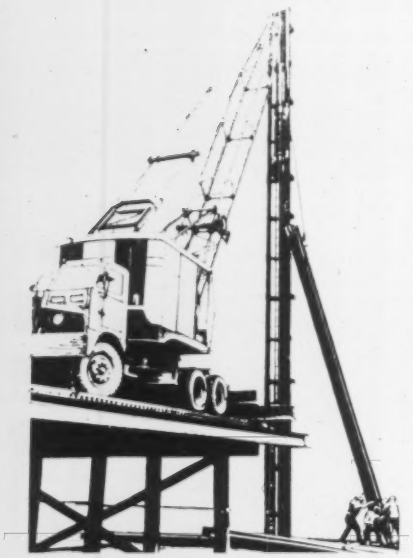
The trucks

Most used tool in this category in highway work is the truck crane, highly mobile, with great convertibility and considerable capacity.

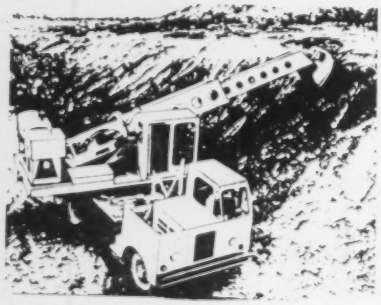
One of the most significant developments in this equipment is that of the 25- and 35-ton truck crane. It is especially well adapted for small bridge work, and some of the moderately heavy lifts of form panels, reinforcing cages and the like. Mounted on powerful trucks, with multi-axle drives, the truck cranes have proved their worth, and their ability to get in and out of



WHEEL TRENCHERS come in many sizes—from machines to open water lines for residential developments to mammoths like this one.



TRUCK CRANE TO PILE DRIVER is a normal conversion trick.



SPECIAL PURPOSE machine is unique in the wrist-like action of its digging mechanism.

difficult spots quickly. Like most other construction equipment, they are increasingly utilized by contractors as material handling equipment, as well as clamshells, draglines, cranes.

Pile drivers

Prime example of the versatility of the boomed machines is their use as pile-driving rigs.

It is well worth noting that the pile hammer is now a vital tool of the highway builder. Once, it was considered only for the heavy waterfront contractor or for building foundation work.

The reason, of course, is the new concept of highway building—a concept that has affected many another piece of construction machinery. Highways no longer are built to skirt rivers, railroads, local streets, bad ground—they flow right over any and all obstructions, particularly in urban areas. Many of the needed structures, thus, must be supported on piles—in some cases, the actual roadway itself is supported on a swamp consolidated by sand drains, placed with special pile rigs.

These new applications of pile driving have imposed an immediate problem for contractor and manufacturer: Often relatively small numbers of piles must be driven at sites great distances apart, often in remote locations; just as often piles must be driven in congested areas, and must be driven quickly and efficiently to avoid hazards to traffic, utilities and structures and avoid delay to other operations.

To meet these requirements, manufacturers are now offering lighter, more mobile, more durable, faster-operating equipment. New hammer designs feature more favorable ram-to-net-weight ratios to pack more power into the light equipment.

Perhaps most significant advance in hammers is the diesel unit. Now manufactured by at least three firms, the unit is completely self-contained, eliminating the need for steam boiler or air compressor (and their attendant workmen) and a considerable length of hose lines. Operating at speeds and strokes dependent on pile resistance, these hammers still present problems for the engineers in determining safe loads for the piles—but they offer a means of driving piles with a slightly altered crane as a basic unit.

Another significant development in the pile driving field is the fast, compact steam generator, which provides full steam pressure in a matter of minutes from a cold start. It is lightweight, economical, automatic and efficient—and easy to maintain—can be mounted on skids, a trailer or on the rear of the piledriving rig itself.

Special machines

Within recent years, there have appeared several striking departures from the conventional crane and shovel—the new machines characterized by almost complete hydraulic operation.

One of these multi-purpose units is about as close to a human arm in operation as any mechanical device now available. Truck or crawler-mounted, its boom can telescope, swing, raise or lower, rotate, and mount a variety of movable attachments: It can dress slopes, clean ditches, place pipe, dig trenches, backfill, and handle a variety of materials particularly in restricted working areas.

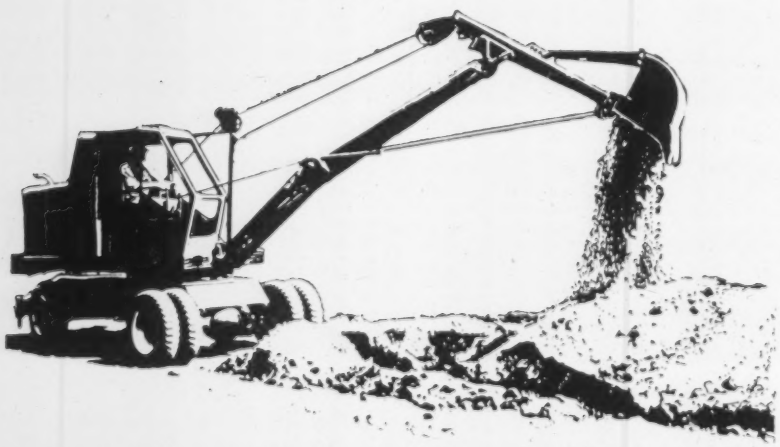
Another new rig is a one-man, rubber tired self-propelled unit with 4-wheel power steering. Its 18-ft, hydraulically operated boom extends automatically, and can carry an extra 6-ft extension. Its application is as a yard crane, pipe carrier, materials handler, and form mover.

A third hydraulic machine is truck mounted, comes in two sizes—5 and 9 tons. With its short tail swing and telescoping hydraulic boom, it can poke a load into a hard-to-get-at place, provides big lifting capacity per pound of crane weight.

Trenchers

Another special-purpose tool that doesn't fall easily into any general category is the rotary or ladder-type trencher. It is, of course, an excavation machine.

Like other construction equipment, development has centered on size and



BASIC RIG—becomes backhoe for small trenching jobs. Self propelled jig transports itself from job to job.

Then—
Under the derby, Henry Holt experiments with his first front-wheel steered crawler tractor.

Now—
Mammoth crawler weighing nearly 60,000 lb claws up tough material with rear-mounted hydraulic ripper.

Tractors and Loaders

Size, speed and rubber

The backbone of any construction equipment fleet is the tractor—most versatile of all construction machines. With proper attachments it can pull, push, dig, load, hoist, and perform any number of other basic functions.

A decade ago, the 25,000-lb crawler was the basic tractor. It had few attachments, except dozer and winch, and its primary functions were pushing and pulling. The rubber-tired utility tractor was just making its bid in construction, and its applications were limited.

Today, there are more types, sizes, and models of tractors than ever before. They range from 10-hp midgets to 400-hp giants. Riding on either rubber or tracks, they can mount dozers, pusher blades, loaders, cranes, rippers, backhoes, rakes, tree-cutting blades, and numerous other attachments.

A crawler with a loader on front and a hydraulic ripper on back can quickly tear up an old pavement and then load it into trucks. It's a one-man operation. Only a few years ago the same job would have taken a lot longer and cost much more.

A small utility tractor today with a loader on front and backhoe on the rear can dig small ditches, lay pipe, and backfill with relative ease. Bigger rubber-tired units, like the self-contained loader, can travel city streets when moving from one part of a job to another. They can spend a few hours at one location loading broken pavement, move to another area and strip topsoil, and jump again to a backfilling operation.

Tractor trends, therefore, move in several directions at once. There are trends to bigness, smallness, versatility—and recently—a definite swing to rubber.

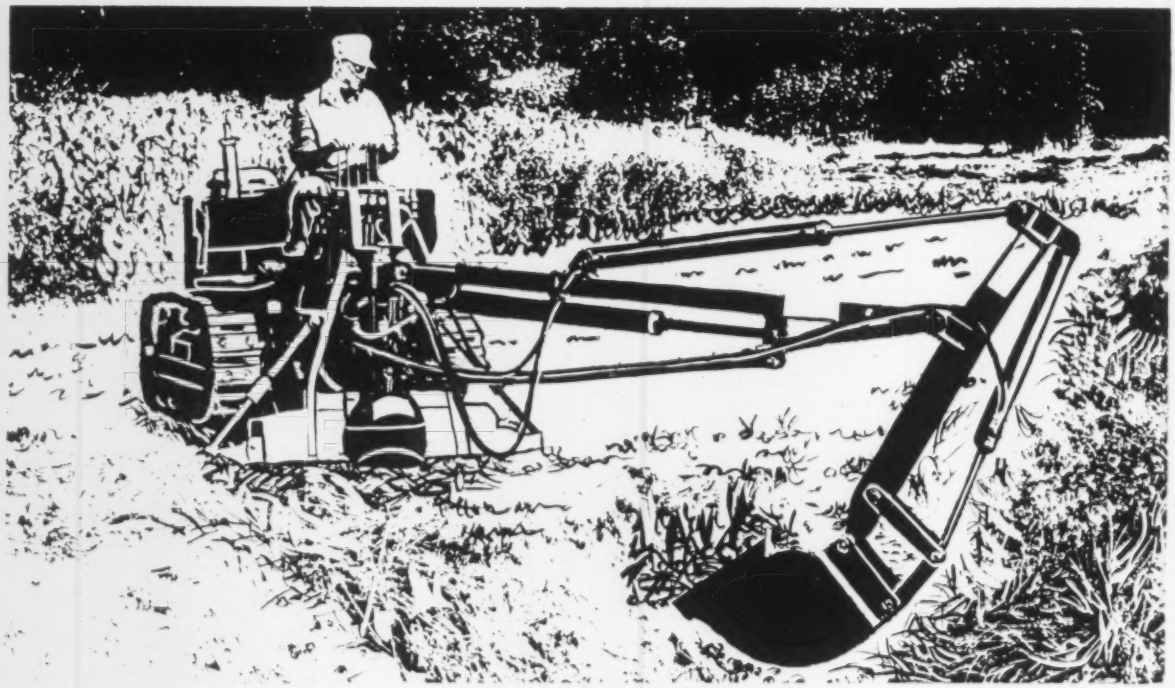
Contractors building superhighways through rural areas are calling for bigger units, more power to produce on fast, high production schedules. For these contractors, you just can't build a tractor big enough.

But other road builders, especially those specializing in urban construction, have different needs. Mammoth machines are useless to them in the maze of traffic, utilities, and restrictions of many jobs. These firms want small and medium size rigs that perform a number of tasks reliably under many and varied conditions.

The crawlers

The real workhorses of any earth-moving spread are the crawler tractors. They don't share the glory of the scrapers, shovels, and haulers, but they are indispensible tools. They push-load scrapers, spread material at the fill, cut slopes and trenches, pull rippers, maintain haul roads, push material to shovels, and perform many other vital jobs.

Crawler tractors range in weight from just a few thousand pounds to nearly 60,000 lb. In all except the smallest models, the engine is a diesel. Gasoline engines still are popular in some lines of tractors weighing less than 10,000 lb.



Small crawler tractor, teamed with backhoe is ideal for variety of light-duty jobs. Mounted also on small rubber-tired tractors, backhoes can cut trenches, clean sewers, dig foundations, excavate pits. Prime advantage is one-man operation.

The primary development in crawlers in the last ten years is the application of more power into longer and wider tracks. Engine horsepower has been progressively boosted in all models, and in some cases it has doubled. Tracks are bigger and much more rugged because of latest heat-treating methods.

The largest conventional crawler now available is powered by a single 330-hp engine. It is used primarily for pushing scrapers because it not only cuts loading time and increases loads, but also greatly reduces tire wear. The big rig can push huge masses of heavy material, climb steeper slopes than ever before, and ride high and dry through wet areas.

Models of small crawlers are numerous. Used mostly by small contractors, they mount a variety of attachments and satisfy a definite demand on landscaping and light excavation work where traction and slopes are a prime factor.

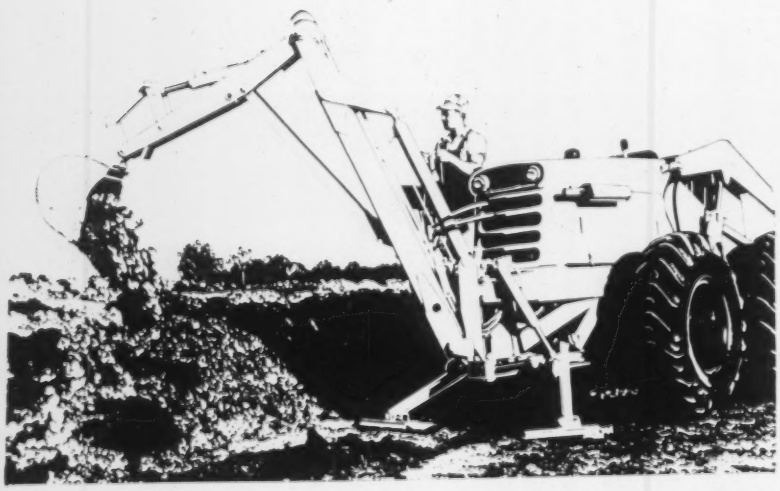
Besides the obvious improvements resulting from better metallurgy, there are a number of significant advances in all crawlers. The operator, for instance, has been given top consideration. The torque converter eliminates the problem of shifting gears; for maximum comfort his seat is fully adjustable and cushioned. Remaining control levers are within easy reach and require only a few pounds pull. Tapered hoods provide improved visibility.

To simplify maintenance, there is a trend to unit construction:

Instead of dismantling most of the tractor to get at an internal assembly, the mechanic can now remove the offending unit without disturbing adjacent components. This type of construction has the added advantage of making precise engine alignment unnecessary.

Another improvement is in the hydraulic track tension adjustment. Instead of the tedious method of adjusting with a huge wrench, the track-chain tension is corrected by a simple hydraulic mechanism.

Improved power trains, lately with torque converters, provide efficient transmission of power to the tracks. Reverse speeds have been increased in years because of new demands on the crawler tractor, particularly in loading or pushing.



Backhoes are now also available for mounting on rubber-tired front-end shovels. High clearance assures easy operation.

Engines boosted

One of the most recent advances in

the biggest crawlers is the turbocharger, which takes waste energy from the exhaust and, by means of a blower device, forces it back into the engine to help it burn fuel better and boost power. It has the added advantage of muffling exhaust noises.

Average engine life has increased hugely in recent years, and one of the primary reasons is a new emphasis on filters and cleaners. Particles and destructive agents in oil, fuel, water, and air accelerate the wear of many vital parts. To keep engine and accessories as clean as possible, filter units have been improved considerably. And, what is more important, contractors are being educated to the importance of replacing filter elements and maintaining cleaners at the proper time. Even the best cleaning device will fail if left unattended.

Crankcase oil filters, and sometimes coolers, are mostly of the full-flow type to prevent particles from running through the system several times before they are trapped. There is also a trend toward placing the filter between pump and engine to remove particles before they can enter a vital passage.

The development of automatic seals has done a lot to extend the life of track rollers and drives. Self-adjusting seals press snugly against shaft and rollers to keep out dirt and water. They require little attention.

Striking departures from the conventional crawler include a new unit with twin 218-hp engines and separate torque-converter drives. Connected by only one transverse shaft, the tractor halves can move up and down independently of each other. Tracks can be moved in opposite directions. And the cooling system is in the rear. Another tractor has a single engine located behind the operator, and it features a special transmission that provides separate control to the two tracks. The operator has a clear view of his work.

On rubber

Although the demand for crawlers steadily increases, on many sizes of tractors, a gradual shift to rubber-tire mountings is evident.

The popularity of the rubber-tired, utility-type tractor and the self-contained loader is well established, and it is only a matter of time before huge rubber-tired tractors take over many more tasks now performed almost exclusively by the crawler. The rubber-tired rig probably will never come close to replacing the crawler in rock, on slopes, in rough ground, and numerous other types of work, but it will undoubtedly make substantial inroads.

The evolution was inevitable. High labor costs, lack of skilled mechanics, and the high price of equipment have mushroomed the cost of maintenance. And contractors know that future equipment must eliminate as much as possible the contact between moving metal parts and abrasive materials.

A new giant in the rubber-tired tractor field is a 55,000-lb machine that mounts a 13-ft 3-in. blade. This new rig has a power-shift transmission, torque converter, and planetary-wheel drive axle. A turbo-charged diesel powers the unit at speeds up to 28 mph, both forward and reverse. Rearwheel power steering permits turns while dozing, with virtually no loss of power or load.

Farm machines grow up

One of the most amazing developments in tractors in recent years is the transformation of the agricultural tractor into a first class construction tool. Today, many agricultural equipment retailers, especially those in or near urban areas, have new types of customers—contractors, utility companies, municipalities, and industrial companies.

Chief reason for the overwhelming growth of the small tractor is attachments, namely the front-end loader and backhoe. With one unit, an operator can load trucks, stockpile material, plow snow, dig trenches, lay pipe, excavate foundations, and backfill. And all at a fraction of the cost of conventional equipment.

Development of the versatile utility tractor has encountered many problems, and a number still exist. Besides the design problems of the backhoes and loaders themselves, there are even trickier questions of how to mount these attachments on the tractor. Generally, attachments and tractor

Tractor shovels are now designed more and more as integral units, rather than attachments. Bucket's tip-back action assures heaped loads. These machines are particularly well-suited for loading, backfilling, and cleaning up.

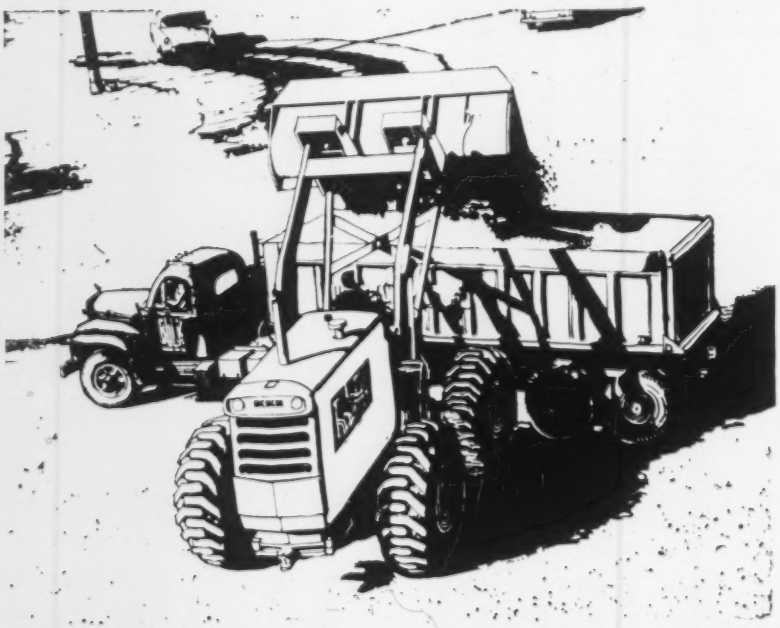
Tractors and Loaders . . .

Small rubber-tired tractors, until recent years confined mostly to farm work, have caught on fast in construction.

are supplied by separate manufacturers—the industry is now making serious efforts to coordinate the two.

The problem was, of course, that the tractors simply were not made to take that kind of punishment. Originally, the machines had been designed primarily to pull a load—not carry it. The attachments now impose the strains of digging, lifting, and swinging of the backhoe, and those of the weight of the front-end loader.

Solutions include beefing up main castings, wider tires and in some cases, a full length, rigid subframe attached to the front and rear of the tractor.



Self-contained front-end shovels, like this 6-yd rubber tired rig, load fast, travel quickly, require little maintenance.

Hydraulic systems have also been a problem. In many instances the tractor's pump and reservoir capacity is too low and control values are not precise enough.

Front-end shovel

Development of the front-end tractor shovel is a major highlight in the history of earthmoving equipment.

On crawlers or rubber, it has revolutionized many types of work, all but replaced the small power shovel for truck-loading loose materials, and is excellent for cleanup work on many types of construction. It works well on backfilling, light grading, and numerous types of loading.

Ten years ago, heavy-duty front-end shovels were available only for crawlers—and they were a far cry from present equipment. In most cases, the tractor mounted an awkward frame on which a bucket was moved straight up and down. The bucket was simply pushed into a bank, the tractor backed up, elevated the bucket along the frame, moved it over the truck, and dumped. The operation was slow, the bucket lost much of its load by the time it was dumped, and maintenance cost was high.

Today, the hydraulically operated bucket with tip-back action has made the front-end shovel a superior tool. Instead of an attachment for a tractor, the unit is now being designed more and more as an integral machine. To get a heaped load, buckets tip back around 40 deg while still in the bank of material. Hydraulic systems have been improved, including bigger filtering and cooling units. And bucket capacities now range up to 6 yd.

Although there is a tremendous demand for all types of tractor shovels, there is a definite swing toward the rubber-tired unit: it can travel by itself at a good speed (up to 30 mph) especially in urban areas, and requires less maintenance. The operator has full view of the work, and the controls are simple. Traction is getting better all the time, and as newer and wider tires are introduced, the rigs will become more versatile.

• **Special purposes**—Not discussed in these pages—because the uses are primarily for special purposes such as pipeline spreads, although they occasionally have application in roadbuilding—are a whole class of special tractor equipment such as sidebooms for laying pipe, railroad rail and other materials, and winches and other equipment that can be powered from the tractor takeoff.

Then—The horse-drawn drag scraper was a fast earthmover fifty years ago—if there were enough horses and men.

Scrapers

Bigger, Lower, and Wider

Without any appreciable argument, construction men will agree that the greatest single contribution to modern earthmoving has been the rubber-tired carrying scraper.

Largely because of this machine—since its introduction as a practical production model in the early 1950's—earthmoving costs have not advanced much beyond what they were in the 1920's, despite sharp increases in the cost of labor, equipment, and fuels.

Basically only a huge magnification of the horse-drawn slip-scraper or Fresno, the rubber-tired carrying scraper of today can load itself (most often with the help of a pusher tractor), haul the load at considerable speed (up to 30 mph), and spread it in controlled depths. It can grade slopes, shoulders or a roadbed with considerable precision, or can build fill or embankment within close limits. With ever-improving design, it can also be used with a shovel or loader as a wagon, to carry and spread material.

Ten years ago, the rubber-tired tractor as a prime mover for the scrapers was just catching on. But today—except on work calling for very short hauls and in very bad ground—the crawler-pulled unit is passing from the construction scene.

Power and more power

A bit of terminology is necessary in considering the type of motive power for the machines. Actually, all scrapers are towed, but some—where the tractor section has only two wheels, and the scraper section also rides on two wheels—are in fact articulated, self-propelled units. So there are really three types of prime movers: Crawlers, four-wheeled rubber-tired tractors, and two-wheeled "overhung" rubber tired tractors.

Choice between the two and four-wheeled machines depends in general, on the length and conditions of the haul. The high-speed four-wheel machines seem to be ideal for long, unrestricted haul. The somewhat slower, but highly maneuverable two-wheel units are best for shorter hauls, in tight quarters, and, generally, in materials offering poorer traction.

To these basic types of prime movers has lately been added twin power plants in the form of fore-and-aft tractors, driving on wheels in front of and behind the scraper unit itself. A late model

Now—Dirt spills from bowl of self-propelled scraper, aided in loading by twin-engined crawler.

Pusher labors at rear end of scraper as 18-yd bowl fills, for spreading elsewhere in controlled layers. Overhung prime mover has superior traction and maneuverability, but it is not as fast as 4-wheel type.

of this type of machine, for instance, consists of a 300-hp overhung type tractor, pulling a 24-yd scraper, and a 218-hp engine on the rear of the scraper, driving the rear wheels. With torque-converters and semi-automatic transmissions, one operator can control both power units simultaneously. The big advantage claimed is traction—with the heavy rear engine mounted right over the driving axle, the rig can climb grades and move through material impossible to a more conventional scraper, and can in some soils eliminate the need for an extra push-loader.

The diesel engines that power the scrapers are now ranging upward of 300 hp—and there are plans for machines with engines of nearly 600 hp.

Push in, push out

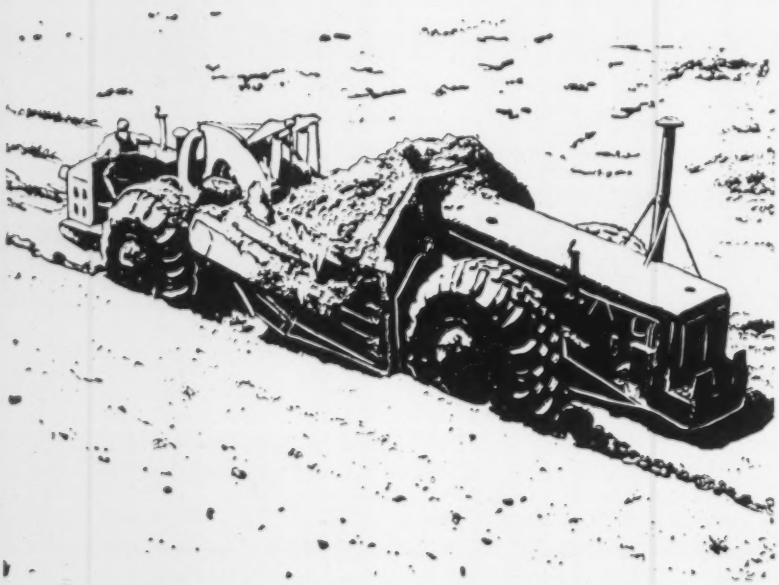
Capacities continue to rise, as contractors demand more capability from the machines. At present, they range from about 4 cu yd up to 35 yd, and again, there are plans for machines to handle over 40 cu yd.

As with the horse-drawn predecessor, the loading of the scrapers is basically simple enough—a knife-edge is pulled through the material to be moved, and the loosened earth slides back into the bowl to be carried away. Control systems for raising and lowering the bowl—and for activating the rams that push the load back out over the knife edge in unloading—vary somewhat from machine to machine. Hydraulic, cable, and electrical controls are available.

Most attention, however, has gone in to the bowl itself, with the trend most strongly toward wider, lower bowls, with as little topside encumbrance as possible. Of particular interest has been design attention to the rear of the bowls—aimed at imparting a boiling motion to the material as it moves back from the cutting edge, so that large lumps are broken up and do not impede other material as it comes in. Result is a bigger load, in shorter time and with less strain on the tractor.

With the low bowls, too, have gone controls to provide a relatively high lift of the edge of the bowl, for fast travel, and for more carefully controlled unloading.

Placement of various moving parts—such as arms for raising and lowering the bowl—has been carefully studied in relation to the position of the driver; the driver's seat has been raised and placed in position for best observation of the vehicle, both front and rear, the remaining control levers placed easily to hand and foot. For quick starting of the big diesel engines, several prim-



Twin-engine scraper offers good traction in toughest materials. Torque-converter-equipped engines are synchronized.

ing systems and both electric and gasoline motors are available.

Coming soon

Although the torque converter hasn't yet taken full hold in the scraper field, several firms now include them as standard equipment, and it is likely that more will follow. Their obvious advantages, which include a considerable reduction in tire wear, as well as better handling for the operator, seem to outweigh any arguments against them.

The nylon-thread tires, of ever larger size and better tread design, offer better and better traction and flotation.

The twin-power (or fore-and-aft) scrapers haven't been completely accepted by the industry. Some contractors seem to fear increased maintenance costs, others are reluctant to buy two power units where they believe one will do—in most cases anyway. But the twin-power scrapers—in addition to their advantages in rough terrain—also seem to offer a one-unit rig useful in stripping topsoil, cleaning up, and grading, where a pusher wouldn't be economical.

Graders

Close cousin of both the bulldozer and the carrying scraper—but a machine with very special capabilities of its own—is the motorized grader.

Here is one of the most useful tools of the contractor—a big, powerful machine, but one that can be controlled with the fineness of a carpenter's fine-toothed coping saw. And the story of its development revolves around improvements in control rather than around size and weight.

Which is not to say that the graders haven't advanced greatly in power and size. Some of them weigh in the neighborhood of 20 tons, carry 190-hp diesel engines. And some manufacturers have seized on the torque-converter to give greater and smoother power.

Control the blade

But, since the grader's principal use is fine grading—and as a piece of maintenance equipment—much of the attention has gone to the problem of blade control. Means of maintaining exact levels, regardless of minor obstructions, of achieving exact tilts for proper mixing and exact levels for grading shoulders and slopes, are of paramount importance.

Some manufacturers have developed means of shifting the blade from side to side by means of hydraulic rams so adjusted that the angle of the blade is not changed. Angle and tilt of the blade itself can be controlled by precision rams, set by dials, to hairline tolerances.

Another, and more spectacular development, is an automatic control that maintains any desired slope of the blade, regardless of unevenness of terrain. Merely by setting a dial to the desired slope, an electronic device controls finished slopes to a claimed accuracy of ⅛ in. in 10 ft. The dial is calibrated in both percent slope and slope ratio. Although the operator can raise or lower the blade to control depth of cut, the slope will remain constant, regardless also of how the grader itself is affected by surface conditions.

Improvements in the metals that form the blades and controlling mechanisms have practically eliminated failure of these parts.

Control the wheels

Coupled closely with exact control of the blade is control of the steering and drive wheels. A lot of the efficiency of the blade and its exact controls depends on the maneuverability of the machine itself— its ability to get into and out of tight places, climb over obstructions, move in almost any direction.

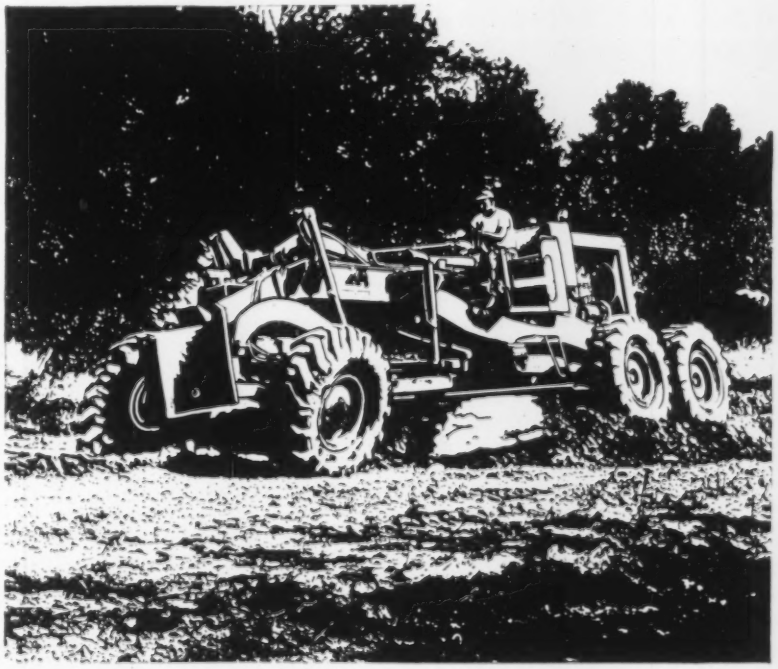
One manufacturer who has incorporated steering on all four wheels for some years, has developed a machine that has six-wheel steering, taking advantage of the more positive control of three-point contact with ground surfaces. These units also feature all-wheel drive which is claimed to deliver more power to the blade.

Because the graders can be steered diagonally, as well as in more conventional directions, they can avoid straddling of windrows, and much slippage on sloped embankments, and can turn in a very small radius.

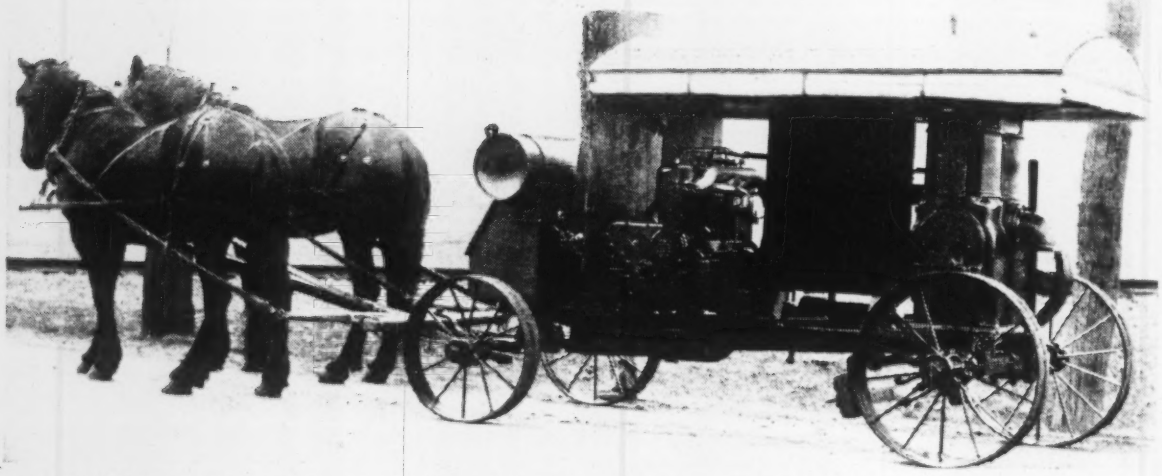
Versatility

As with most other construction equipment, contractors have discovered that they can do a number of other things with the graders, despite the fact that the machines are essentially a special purpose unit. Light bulldozer blades, for example, are available for attachment to the front of the graders for comparatively small work; scarifiers and other attachments are also available, as well as elevating belt-conveyor attachments that can load trucks or pile material to one side.

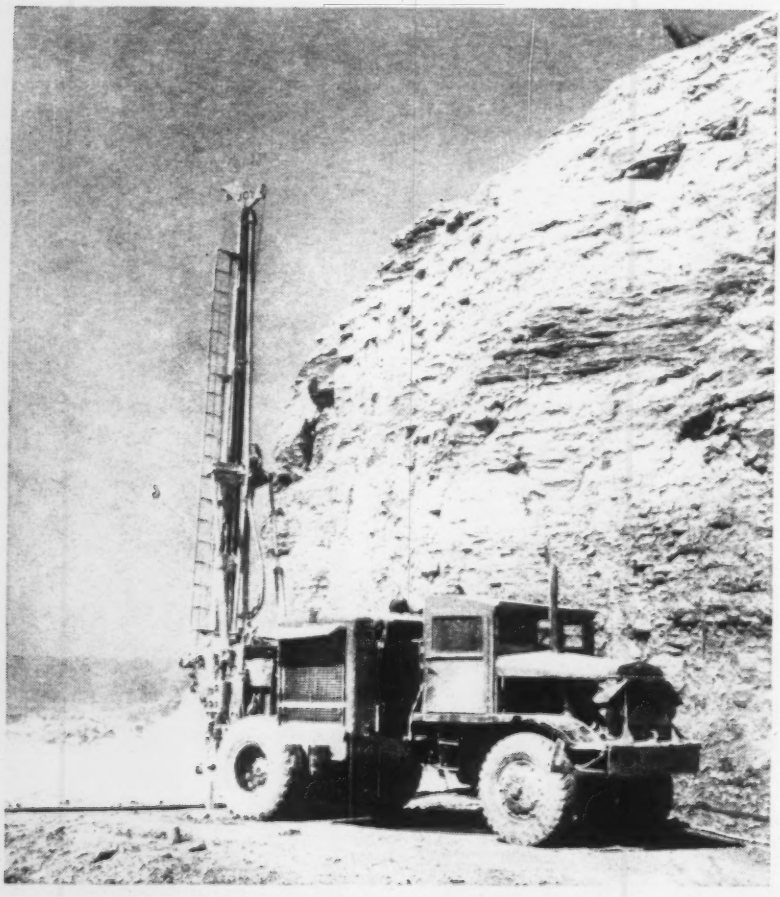
In general, manufacturers report that travel speed has increased about 35% over the past few years; reverse speeds are up over 100%. High-traction, low pressure tires and simplified controls, new concepts of power linkage to increase drive to the wheels, power steering, are all present on existing machines.



Better controls of blade and wheels are major advances in graders. But contractors want more—like giant rig to repair haul road in single pass.



Then—Portable compressor was steam-powered unit towed by a team of horses. It led to today's highly mobile, compact rigs, delivering air at rates up to 900 cfm.



Now—Truck-mounted drill does fast job of sinking 4-in. blast holes in contractor's aggregate quarry. Compressor is set behind cab. Control panel allows operator to handle majority of functions from one position.

Drilling and Blasting

Greater Efficiency, Better Control

Since the dawn of history, men have been concerned with finding some way to cut through and remove rock. Ancient Egyptians discovered that by dipping papyrus reeds into abrasive material and then rotating the reeds they could make a fairly effective drill. The Etruscans and Romans invented metal saws—some of them even with precious stones embedded in their cutting edges for greater efficiency.

Most other ancient races knew that rock could be split by alternate heating and sudden cooling with water and even vinegar (which added acid action to the cooling effect). But it was not until blasting powder began to come into general use in the early 19th century that rock removal methods commanded any scientific attention.

For some time, efforts to improve drilling and blasting techniques have concentrated on three phases: The drills themselves, power for the drills, and on explosives.

All three phases have made giant strides in the last 10 years. Today,

drills are cutting bigger and deeper holes, compressors have become more and more compact and efficient, explosives are more reliable and controllable.

Drills

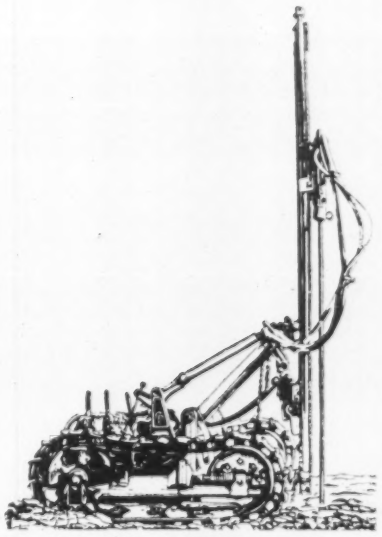
The story of the drills themselves divides into two parts—methods of drilling, and metals.

In most types of rock, the percussion drill is most efficient. It is, of course, only a magnification of the hand-operated chisel and hammer—a matter of hammering a metal bit against a rock, rotating the bit between blows in order to cover the full face of the hole.

A second basic type of drill—the rotary, with a toothed bit rotating at the bottom of a shaft powered from above—is particularly adapted for use in softer non-abrasive rock. Rotaries can drill hard rock, of course, but the cost in bits is high. To make them more versatile, several manufacturers are offering machines that can be quickly converted from rotary to percussion action.

The trend in percussion drills, however, is definitely toward greater mobility, and the drilling of bigger, deeper holes at a faster rate. This is in part the result of the contractors' desire for better production—but it is also attributable to fundamental changes in highway design, which demands smooth, level roadways, regardless of surrounding topography. The result has been bigger, deeper cuts and more frequent tunnels.

The long-honored standby of the rock driller—the rubber-tired wagon drill—



Crawler drill climbs steep grades, tows compressor behind. Air motors operate each track.

is still the backbone of drilling operations. But as the job to be done moves into ever rougher terrain, these drills lose some of their effectiveness—the machines are tough to maneuver in many areas, and their effective drilling depth is rarely more than 20 ft.

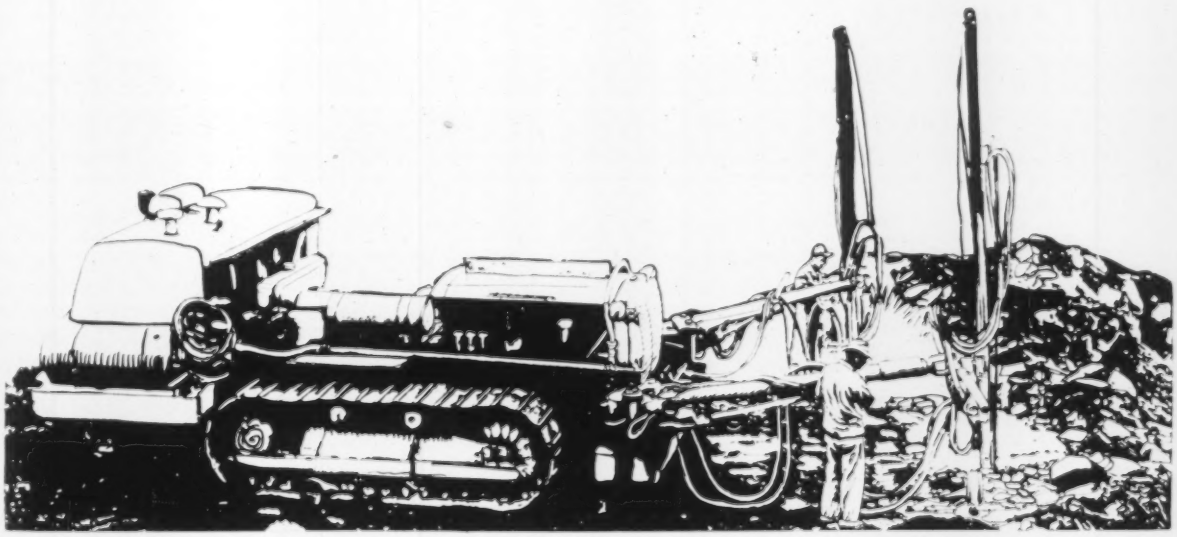
Mount 'em and move 'em

As has happened in many other types of construction equipment, the contractors were the first to see the need for better drill mobility and more power. And, about five years ago, many contractors had manufactured their own rigs, by mounting wagon drill components on the dozer arms of old crawler tractors. Some of these contractor-built machines towed compressors, others mounted self-contained units, and some provided drill power directly by connecting the compressor unit directly to the tractor's rear power take-off.

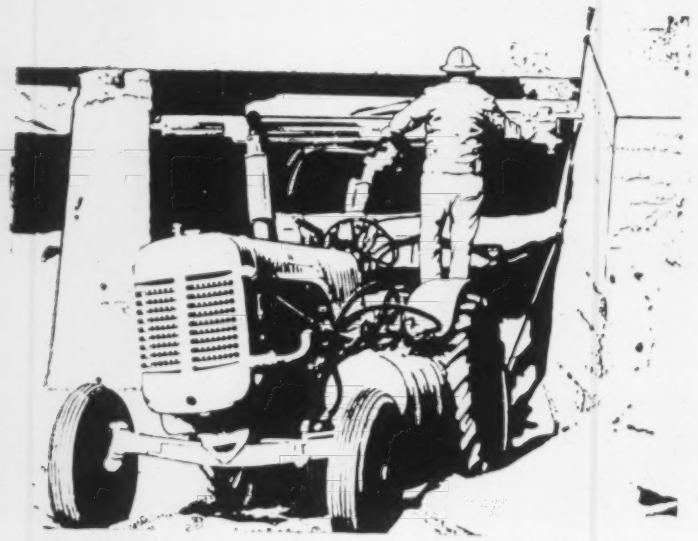
On really deep cuts, however, the road builders still searched for drills that could sink large blast holes to depths of 30 ft or more—a 4 or 6 yd shovel can pay off in big, deep cuts, but only if there was a high enough bank of blasted rock available. So contractors began to use a number of large-hole drills popular in quarry work. These worked well enough on big highway jobs, but sometimes it was found that the size of the hole drilled was too large for optimum fragmentation on blasting. And they were not practical in or near built-up areas.

The manufacturers began to catch up fast. Within the past several years, a number of firms were offering new machines—for instance, a heavy duty wagon drill mast that could be mounted on hydraulically controlled jumbo arms at the front of a crawler tractor, with a 600 cfm compressor for mounting on the back. These, of course, are more refined versions of what the contractors had built for themselves—and they work well enough in most secondary types of rock drilling and blasting.

More recently, the manufacturers have come up with a new line of drills



Tractor carries complete drilling outfit. A 600-cfm compressor on back supplies air to pair of heavy-duty drill masts in front mounted on hydraulically operated jumbo arms.



Tractor-compressor units pay off for many types of specialized light drilling. Completely self-contained, they mount drifters, pin drivers, and other types of drills.

—self-propelled crawler machines that can sink holes from 3 to 4½ in. in diameter to depths of 30 and 40 ft, can climb into position nearly anywhere hauling their compressors behind them.

Several of these machines may be called crawler-mounted wagon drills—carrying heavy drifters, operating on tracks that can be controlled independently, and with hydraulic or air control of feed, drill and carriage. They are so rugged that they can tow a 14,000-lb compressor up a 10% grade. Another is a completely self-contained rig that includes its own crawler tracks, a compressor, dust collector, hydraulic levelling jacks and even mechanical drill steel changers.

Metals

With the improvement generally in the manufacture of the steel itself has come a major advantage in time and materials saving for the driller. Special alloys have done a lot to extend the life of drill steel.

And today it is no longer necessary for the driller to keep on hand a supply of drill steels in graduated lengths for deep holes. Now, he can simply add sections as needed and continue drilling. But primary credit for this advance goes to long life bits, which eliminated the need for frequent removing of steel and changing bits.

The development of detachable steel bits has been significant. The bits are made of better alloys, and are offered in a number of shapes and sizes. Both single and multi-use bits are available.

With the bit improvement has come the carbide-insert bit, with their tungsten carbide cutting edges that have proved extremely resistant to wear and shock. Much more expensive than steel bits, the carbide-inserts are generally more economical in hard rock work.

Large-hole drill operates new type hammer which goes down the hole with bit.

Compressors

Many construction men consider the introduction of the rotary compressor unit—around 1950—as the most significant change in compressors during the last 10 years. In general, the industry isn't completely sold on the unit—but its advantages of light weight, compactness, cool operation and minimum maintenance are overcoming resistance to it.

On rock work, the 600 cfm portable unit is the most popular, for the very good reason that it can supply power for two wagon drills. Larger models—up to 900 cfm—can handle three wagon drills, or two large-hole drills. Much smaller compressors are also available for a variety of applications—including power for saws and tampers as well as smaller drills, and some firms are now offering tractor-compressor combinations.

And blasting

Although the quality, uniformity and variety of explosives on the market has increased considerably during the past 10 years, the most significant advance has been in the control of the blast itself.

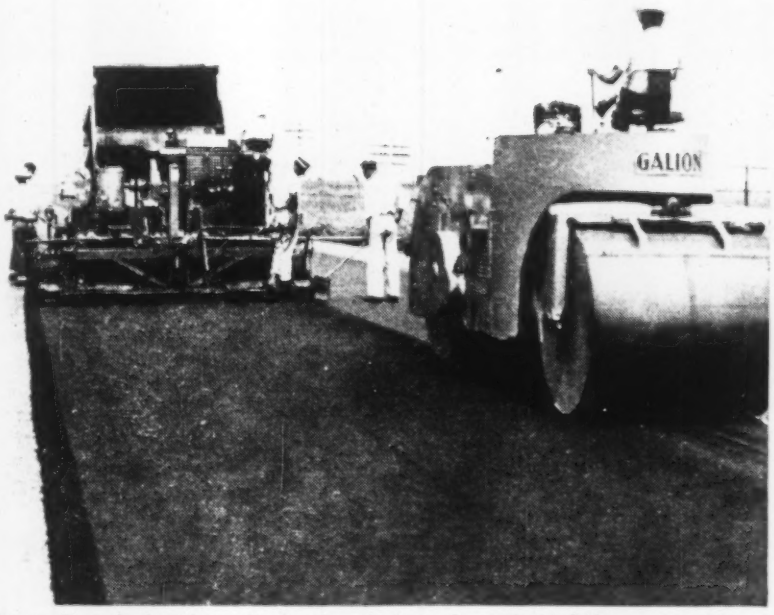
With the introduction of millisecond delay blasting caps, the contractor obtained a method of breaking out rock exactly where and in the sizes that he wanted it—and with considerably less noise, vibration and throw. Basically, the technique is one of reducing one big blast into a rapid series of smaller blasts, obtaining maximum fragmentation by subjecting the rock to consecutive stresses.

Another advance has been in development of methods of confined détonation—or rather, of improved methods for stemming the drill holes above the point where the charge is placed, in order to prevent loss of explosive energy.

Tight stemming, plus placement of the priming cap near the bottom of the hole, produces less noise and throw, but better concentration of the energy on breaking out rock. It is of real importance in blasting work in urban areas, where noise and throw can be a real danger.

And one of the newest ideas in percussion drilling is the "down-the-hole" hammer, for deep-hole work. Slightly smaller in diameter than the bit, the hammer is mounted just above the bit and powered by air passing through hollow drill rods. The hammer thus goes down the hole with the bit, by direct drive eliminating power waste that normally occurs when power is transmitted through rods and joints.

Then—Horse-drawn bottom-dump wagon and 3-wheel steel roller, were standard when the 1909 Road Show was being held.



Now—Two-wheel tandem roller travels at high speed over freshly-laid pavement. Torque converter assures smooth acceleration.

Compaction Equipment

Vibration. Greater Mobility

Although highway engineers have widely diverging views on the mechanics of roadbuilding—there's one point on which they all agree: the need for a high degree of compaction of all levels of the roadway—fill, base, and top. Stability, resistance to permeability, and insurance against settlement are in direct proportion to the effectiveness of compaction.

In many cases, the huge tires of hauling equipment provide all the rolling that's needed. But in other situations it is not enough; the contractor must turn to a group of special machines, to complete a highly scientific operation.

Emphasis on compaction is a relatively new idea. Years ago, it was strictly a secondary function of horse and wagon teams as they moved over the fill. Later, the steam roller was pressed into service by adding bands or corrugations to its rear wheels to develop penetration. And the early crawler tractors also did their share of packing the fills.

But more specialized tools were needed. By the early thirties, the sheepsfoot roller was catching on as a first-class rig for highway fill compaction. Today, because of its excellent kneading action, it is still the standard compaction tool. Fitted with either cylindrical, shoe- or tapered-type feet, the unit is pulled back and forth across a fill until it almost walks itself out of the ground. The bigger sheepsfoot rollers are towed, generally, by crawler tractors—and this is the contractor's major objection to the machine. At the high price of present equipment and its maintenance, contractors are unhappy over what they consider the waste of a tractor on simple towing. What they want is a self-propelled machine, more universal than present compactors, capable of maneuvering up slopes and over embankments without getting stuck.

Compaction . . .

Rubber comes in

A more recent type of compactor is the rubber-tired wobble-wheel roller. It is one of the most universal compactors, because it has applications on fill, base, and top work. It works especially well in granular soils, and more recently, has been doing a good job of finish rolling on stone bases and bituminous concrete. Because it simulates traffic, it is useful in consolidating areas that will not have the advantage of normal traffic processing—such as ramps, parking areas and other lightly travelled sections.

Towed or self-propelled, the modern version of the wobble-wheel unit consists basically of a ballast box carried on two lines of oscillating axles mounting small, smooth-faced pneumatic tires. The wobble action permits tires to follow the ground contour closely. To assure full coverage of the pass, tires on the rear line of axles are placed so that they ride over areas left between each set of front tires.

A modified version of the wobble-wheel introduced last year combines some of the characteristics of both rubber and steel wheels. Pulled by a rubber-tired tractor, the unit consists of a semi-trailer-type ballast box mounted over a single axle of wobble-wheel tires. And directly in front of the tires is a retractable steel wheel. After initial compaction, the steel roll is lowered to iron the ridges. With this machine, it is possible for a small contractor to compact and level the subgrade of a parking area, for instance, with only one unit.

More recently, this same unit was improved even further. It now offers a sheepsfoot roller that can be interchanged with the drive wheels on the tractor, and a vibrating unit so that the same machine can now be used to provide four types of compactive effort. The 60 hp prime mover has 180 deg hydraulic steering for better maneuverability.

Pneumatic triple tamper does quick job of compacting backfill in trench.

Another departure from normal compacting equipment is the grid roller. An open roll covered with a grid, or lacing of steel, the rig can be used not only for compacting fills but also for crushing in-place road fill or pulverizing old pavements.

For special types of compaction, especially on runways requiring extremely high densities, the giant rubber-tired roller has been indispensible. Built as a semi-trailer mounted on a single axle, these giant compactors are sometimes ballasted up to 200 tons. With that much weight, their primary duty is to apply test-loads.

New developments

Two of the most striking advancements introduced in recent years are the segmented steel-wheel roller, and the vibrating compactor.

The segmented-wheel units are popular in certain non-granular soils because of the tamping action of their feet, and because they are self-propelled. They work best in non-clogging materials, and where grades are not steep.

A more radical departure from earlier conventional units is the towed vibratory roller. Relatively light cylindrical rollers, they greatly amplify their deadweight compactive effort by vibrating while in motion. They work especially well in soils with low cohesion factors—sands and gravel fills and crushed stone bases.

Vibration has two measurements: amplitude—the maximum vertical force imparted to the soil particles; and frequency—the actual number of oscillations (impacts) per second.

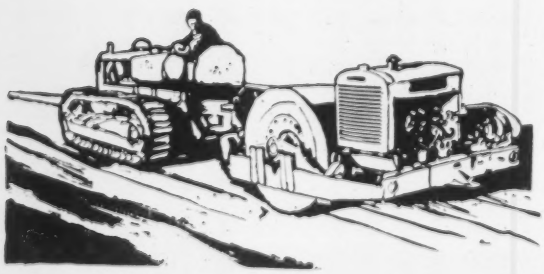
The vibration is imparted by constant speed, revolving weights within the roller drum. Power is supplied by a gasoline engine mounted on the unit. Weights can produce vibrations at a rate of between 3,600 and 4,500 per min, depending upon the size of the roller. These high speeds of vibration reduce any tendency for the roller to "hop" under the impact, but in addition, the weight of the machine itself is enough to hold the roller in constant contact with the surface, thus forcing the vibrating action downward through the surface and subsurface.

One desire has been voiced by contractors, however: They want bigger and wider machines of this type than so far are available.

Another type of towed vibratory roller rides on rubber tires. A vibrating unit driven by a gasoline engine imparts 700 to 1,400 cycles per min directly to the rig's single axle. Rate of vibration can be varied to suit different soil conditions.

Base compactors

Standard unit for stone base compacting is the three-wheel roller. It has two high and relatively narrow steel wheels in back and one low and wide wheel in front. Weighing between 10 and 20 tons, these units dominated the scene until recently when the self-propelled, multiple-shoe, vibrating



Vibrating roller, towed by crawler tractor, offers high compactive effort for lightweight machine. It's ideal for granular soils.

Self-propelled compactor passes electrically vibrated shoes over stone base. Shoe-type units have gained wide popularity in recent years because they are simple, do a thorough job of keying stone base, and can be modified to suit many conditions.

units were introduced. In a few short years, these machines have replaced the three-wheel roller for initial base rolling on many jobs.

Vibrated either mechanically or electrically, the multiple shoes pound the rock at a machine-gun tempo, keying the base materials together and forcing choker dust deep into the voids. Often the rigs are operated in echelon to cover the full width of a road in one pass. Another advantage is the flexibility of shoe mounting. Shoes can be fixed to compact slopes, ditches, and many other odd-shaped surfaces.

Finish rolling of bases is accomplished most often by tandem steel wheel rollers.

Surface rolling

Smooth steel-wheel rollers are now limited almost exclusively to base and top compaction. There are two basic types—the three-wheel and the tandem. As mentioned before, the three-wheel unit, because of the excellent crushing action of its heavy rear wheels, is best for rolling base. The tandem unit works well on base, but also does an excellent job on bituminous concrete. These units range from miniature one-ton models for driveway work to 20-ton machines for laying turnpike pavement. Tandems are often preferred for finish rolling because the rolls follow directly behind each other, eliminating the ridge that sometimes results from a three-wheel unit.

The popularity of the three-axle tandem has grown steadily because it works well on so many applications. Besides a main drive roll in the rear, there are two guide rolls in front with syncromized hydraulic steering.

Key feature of the three-axle tandem is the transfer of weight to any roll that is riding a bump. On some models the rigid connection between the twin guide wheels can be unlocked for a more even distribution of weight, regardless of ground contour.

Smaller models of the two-axle tandem, especially those around 6 tons, are very popular with the small contractor. Mobility is the secret of the small unit, and to accomplish this most manufacturers have built in retractable wheels to facilitate towing.

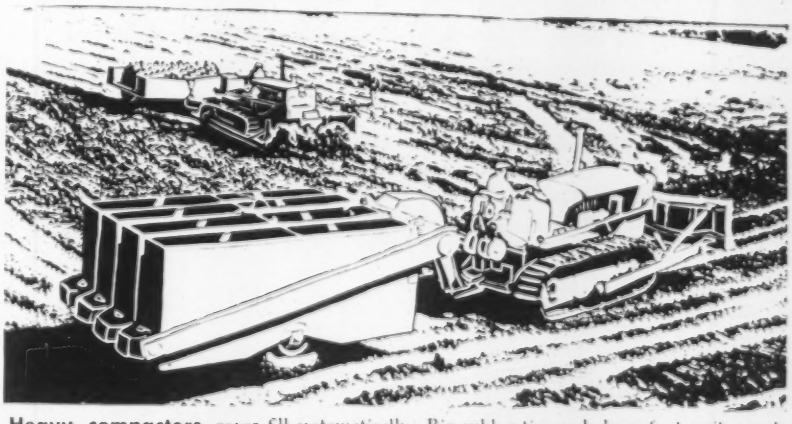
A special-purpose unit gaining new popularity because of extensive road-widening programs is the trench roller. Latest models have two steel wheels which can be adjusted to cover the full width of the trench in one pass. Leveling wheels ride on the pavement.

Primary advancement in steel-wheel rollers is the torque converter. By eliminating gear shifting, the unit provides smooth starts and stops, producing a better finish.

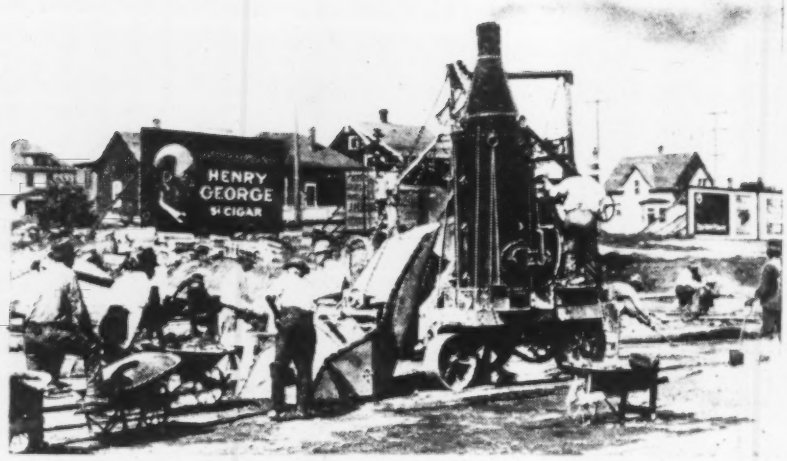
To handle the multitude of compacting conditions in restricted areas, against walls, in ditches, and around manholes, a number of hand-operated power tampers have been developed. Most common is the single and multiple pneumatic unit powered by compressors.

More recently, a number of self-contained units have been developed. One type operates by jump pounding.

Hand vibrating tampers are also popular. Powered mechanically or electrically, the plate or foot vibrates at frequencies of several thousand cycles per minute. Some are "walked" by hand and others are pushed or wheeled.



Heavy compactors cover fill systematically. Big rubber-tire and sheepsfoot units must be towed by crawler tractors.



Then—In the days of the 5¢ cigar, steam-powered mixers rode on steel wheels, were charged by wheelbarrows.

Paving Equipment

Better controls for batching, mixing, and finishing

The most obvious part of a road is the pavement—a surface of some kind over a path that leads from one place to another—something to keep men and machines operating despite the vagaries of the weather.

But when you talk about paving, nowadays, you begin at a point well below the surface. And so you must consider all manner of machines and operations that have as their combined result one thing: A good, smooth, hard surface that will stand up under wear and weather.

With the increasing dependence of a nation like the United States on its motor transport, the old ideas about how to build a road began to develop serious gaps. The fact was that the roads weren't standing up, they were rutting, they were rough, and they wouldn't permit fast travel.

The answer—and it is of comparatively recent discovery—was finally found in considering what lay under the surface. The base and the sub-base under the road would control the surface, no matter what it was.

To prepare the sub-surface, a whole host of machines has been developed or adapted: The scrapers and 'dozers; the tampers and all manner of other compaction equipment; the special truck bodies, the various kinds of mixers. Most of these are of such special nature—or belong so clearly to a family of equipment—that they are treated separately in other sections of this special report.

A rock crusher, however, cuts across the field—whether it produces stone of the right sizes for a sub-base, or aggregate to specifications for a concrete or asphalt mix. Without these machines in their present state of development, and the screening plants that separate and grade their product and many of the finely-graded mixes now being called for by the engineers would be impossible.

Break 'em down

Since man first began to try to shape his world to suit his own convenience, he's had to cope with rock—some means of reducing it to manageable sizes and weights. Lately the problem has been complicated by the need to bring it to exact sizes for aggregates of all types.

Methods evolved by earliest builders remain basically the same today—you can crush the rock, break it with a hammer, grind it down. What modern manufacturers have done is add immense mechanical power to these processes.

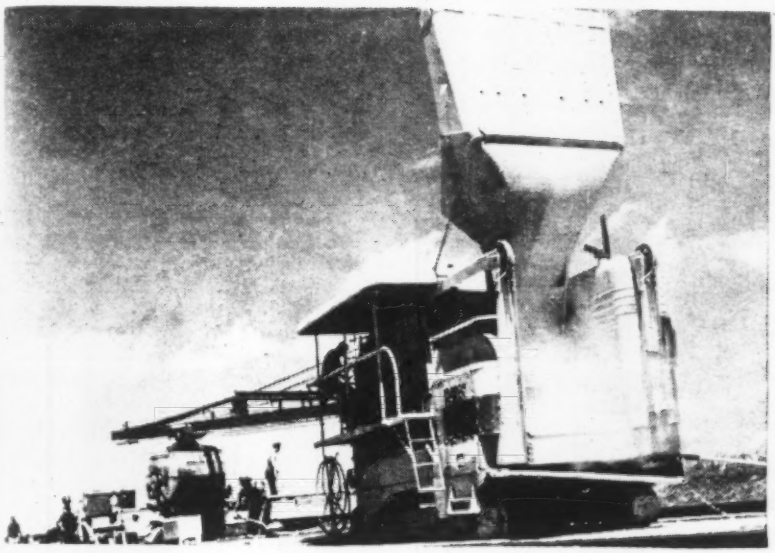
Today, there are four basic types of crushers in general use: Jaw-crushers, roll crushers, gyrating or cone-type crushers, and the impactor and hammer mill. The names are quite descriptive. The jaw-crusher works on the principle of the human jaw, with one jaw movable, crushing the rock against an immovable second jaw. The rolls take the stone between them and reduce their size by crushing; the gyrating or cone-type crushers work on almost exactly the principle of the chemist's pestle-and-mortar. The hammermill uses a series of metal sledges to shatter and crush the rock.

The jaw and gyrating crushers are generally used to crush larger, harder rocks down to fairly coarse sizes, the rollers and the hammermills to take smaller rock and bring it down to sizes well below 1½ in.—right down to pea size.

What's happened to the crushers from the contractor's viewpoint, though, could be put in two points:

Size of the basic machine has been progressively reduced and mobility added so that instead of a huge, stationary monster usable only in a fixed quarry or gravel pit, the machines—mostly on rubber tires—can now be moved from job to job and to convenient locations on the job.

Versatility has been increased by combinations and refinements. Manufacturers have combined several different crushing operations—such as jaw crushers and rolls—so that a single machine can handle several kinds of rock both as to size and hardness. Double and triple roll setups are available.



Now—High-capacity, self-propelled, engine-powered paver mixes concrete automatically, spreads it neatly.

Additionally, through combinations of the crushers with screens and other devices the rock can be separated to various sizes, down to sand and gravel. And the combination of the crusher with belt conveyors and screw and bucket conveyors make it possible also to move and load the material.

Asphalt paving

A number of machines have been developed to speed up and make simpler the job of preparing base and sub-base.

Most popular for recent years have been box-like devices mounted on the dozer arms of crawler tractors to put down accurate lifts of base materials. Trucks empty directly into the box while the spreader pushes them ahead. Adjustable wheels permit accurate thicknesses of material. Lately, however, some contractors have felt that it involved the "waste" of an expensive tractor. And from this has come the development of self-propelled spreaders, mounted on crawler tracks, that can spread base materials up to 16 ft wide and 20 in. thick. An oscillating V-type screed at the rear of the machine levels the material as the spreader moves.

Asphalt plants

Asphalt plants have also come a long way in the past decade.

In general, the changes can be stated this way: The asphalt plants are getting bigger, a 6,000-lb capacity plant is now common; they are being equipped with nearly complete automatic controls to handle all operations; they are being made portable (in knocked-down form); they are being equipped for electric power to cut down maintenance, weight; and they trend to batch-type plants, especially where highest-type pavements are required.

Some contractors are now leaning toward the conveyor and reclaiming tunnel methods of feeding aggregates to large batch plants, rather than by the long-conventional clamshell loading a feeder-hopper. The conveyors give good control in proportioning aggregates, cut breakage from handling, and allow the plant to switch quickly from one specified mix to another.

Methods of heating the asphalt plants have also seen some recent changes. In order to keep the asphalt plastic, storage tanks, pipelines, metering devices, weigh buckets, pugmills and fuel oil systems have long been jacketed for heating—normally by steam. But in recent years, there has been a wide swing to hot-oil systems, eliminating the need for a large steam boiler, with its accompanying problems of maintenance, safety, cost, water supply. The hot-oil systems operate from a single heater, circulate oil through the plant. Electricity is also being used as a heating system. Electric elements heat the tanks and pipelines, and an electrically-heated hot-oil system handles the weigh bucket, and pugmill.

Another problem—operating a big asphalt plant close to built up areas—has been solved by improvements to dust collecting systems. Water-type filters can remove practically all fines and reduce exhaust to steam and little else.

The asphalt pavers—also attended by trucks, but followed usually only by rollers—are another story. Their raw material is delivered directly by truck from the asphalt plant, and they run on their own tires or tracks directly on the prepared base, laying the finished surface behind them.

Ingenious manufacturers have incorporated such features as a heated, vibrating strike-off blade at the rear of the machine to "iron out" wrinkles in the pavement and compact it firmly. Used in echelon these machines can lay an entire surface for a superhighway in one pass—except for rolling.

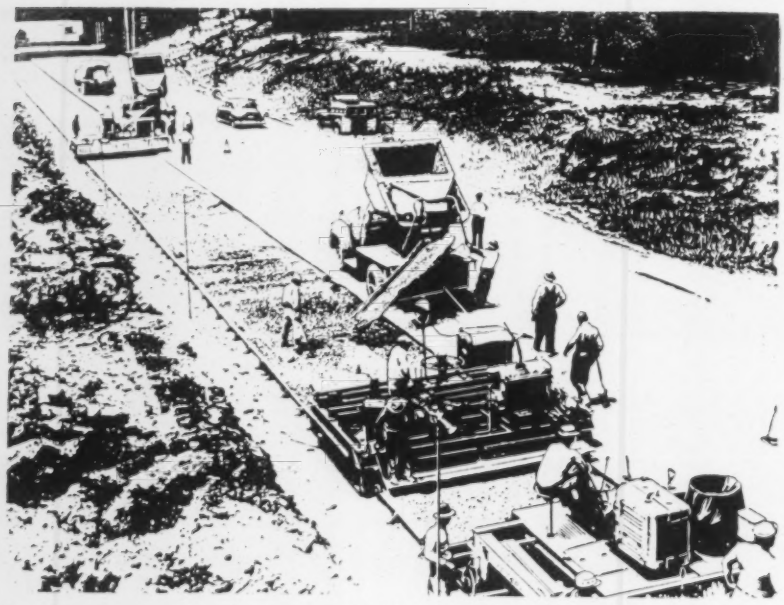
The crawler-paver can outclimb the rubber-tired models on grades, but the speed possible with the rubber-shod machine makes it popular.

Concrete batching

Probably least dramatic—from a spectator's viewpoint—but one of the most important developments in paving practice has come in the field of concrete batching plants.

Again the basic problem is simple enough—storing the right-size aggregate, the cement, and additives in a convenient place, and delivering them in the right quantities when needed. The basic answer is equally simple—a hopper type bin controlled by some sort of a gate.

But to this basic concept have been added two things that change the picture radically: Mobility, which makes it possible to bring the bins quickly to the job; and extremely accurate controls—mechanical, electrical, even electronic—which make possible the accu-



Paving spread gets concrete in special dump bodies hauling plant-mixed concrete to job site, chuting it in front of finisher.

rate proportioning now required by engineers.

None of the portable units are electronically equipped as yet, but most companies have equipped their bins with mechanical controls and scales with the accuracy of a fine watch that weigh out many sizes of aggregate, and cement, at one time, discharging them into trucks for transport to a paver at great speed. Improvements in the controls have rapidly cut down, also, on manpower needed to operate the bins, batchers, and mixing plants.

Electronic controls have begun to appear on these plants within the last two years—exclusively, at the moment, in large stationary plants such as ready-mix concrete headquarters operations. But applications of these controls are sure to come for field installations.

Batch plants charged by clamshell accurately weigh and record aggregates.

Leading the paving spread often are small tractor-compressors which supply air to pin-drivers to make a quick job of anchoring forms. Small trucks and self-propelled cranes, of course, speed handling and setting of steel and forms.

Behind them, fine-graders ride the forms prior to the concrete paving operation to remove excess material. They are still popular—but some contractors are beginning to show preference for finegrading attachments for graders, that permit the grader blade to follow the forms in order to fit the depth of cut. At the moment, removing this excess material is a problem most often handled by a front-end loader—but in the future, attachments may be developed to permit the grader to do the whole job.

Concrete pavers

Important as are the foregoing units, the machine that most quickly means "road" to most observers is the paver itself.

In concrete work, the paver (with one exception) is nothing more than a self-propelled concrete mixer of comparatively large capacity (1 to 3 cu yd), equipped with a discharge bucket that can be moved on a boom to deliver concrete to the desired location.

Usually working off to one side of the area being paved, the paver is attended by trucks which deliver water and aggregate-cement. It must be followed by a train of special machines that strike off and consolidate the concrete, smooth it, and put on finishing touches.

There has been little basic change in the paver over the past 10 years or so—but there have been numerous improvements. These include hydraulic controls to speed batch transfer, operation of the discharge chute and bucket spotting; automatic batch controls that allow the operator to spend more time on other activities; improved gates on buckets for gradual opening and thus better control of spreading. All pavers today are designed with reduced heights, to permit them to crowd under bridges.

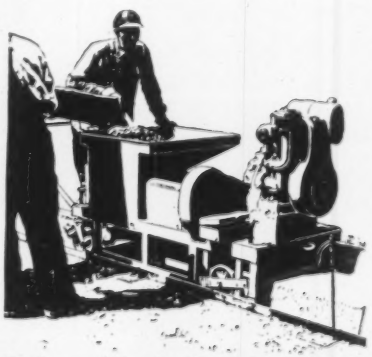
Most revolutionary development in the line of pavers is probably the so-called "formless paver" that combines within itself the functions of striking off, smoothing the concrete (though the machine is still served by an offside mixer), and additionally, carries its own forms trailing behind it far enough to let the finished concrete set sufficiently to maintain its shape.

And under certain conditions there's competition for the pavers—in the form of the ready-mix trucks which can deliver as much as 10 yd at a time directly into the forms, and of special truck bodies of considerable capacity that can take mixed concrete directly from a central plant and deliver it without further agitation—to the forms.

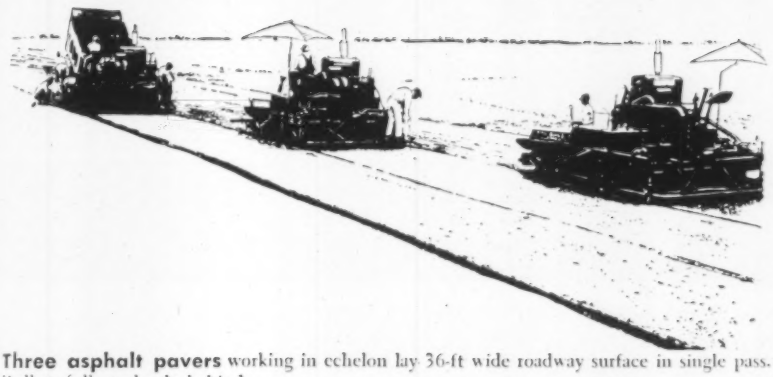
Concrete finishers

The train that follows the concrete paver is a fascinating procession of machines that are today uniformly more powerful, faster and more mobile.

Riding the steel forms, these machines can handle single or double lanes at one time, spread the concrete evenly (some using vibratory equipment) without splashing it out of the forms; screed



Curb machine is self-contained miniature, taking concrete from hopper, vibrating and forming, moving under own power.



Three asphalt pavers working in echelon lay 36-ft wide roadway surface in single pass. Rollers follow closely behind.

the concrete smoothly; form dummy joints; and spray curing compounds on the finished surface.

Concrete spreaders are now being improved to spread the concrete more smoothly and quickly, without splashing it outside the forms, and these same machines also tow or mount various types of vibrators—with power-generating equipment mountable on the spreader.

And of course, some hand operations are still required—men with the old-fashioned "bull float" still follow the machines in many cases to give a final finish. On the finishers, contractors report one feature that still needs attention: Because of their eccentric-type drives on the reciprocating screeds, there is a "throw" at the beginning and end of each cycle, which produces surface irregularities in the concrete. Some manufacturers have experimented with hydraulic and improved mechanical drives to eliminate this condition. Some models now available can widen themselves to handle ramps and other areas where lane widths are variable.

Generally, the last form-riding machine is the paving train is the curing machine—a unit of fairly recent vintage. Self propelled, this machine carries a full drum of curing liquid and a reciprocating nozzle that sprays the liquid uniformly on the concrete. Often, a broom travels on a transverse belt at the front of the unit, to apply texture to the finished concrete.

Another development for concrete paving is the self-propelled powered saw. In their search for speed, builders have discovered that it is easier to put down the slab in long continuous sheets, sawing joints after the concrete has set to some extent.

And, for use in both concrete and asphalt paving, numerous small machines have been developed to lay curbs and guters. Self-propelled, moving either on the forms or on their own wheels, these machines are miniatures of the paving operations, though usually handling within themselves the operations of vibrating and screeding.

In all, however, the main development in the paving operation has been more than any individual machine—it has been in the development of closely coordinated teamwork between the machines. Split-second timing of truck operations, increased capacities and accuracy of the batchers and mixers, closely-spaced operation of preparation and finishing machines are the key to successful, economical operation.

The manufacturers are concentrating to an ever greater degree on this phase—speed and accuracy.

Secondary roads paving

In any discussion of roadbuilding on a nation-wide basis, it must be remembered that by far the largest part of the more than 3,300,000 miles of improved road in the U.S. are low-cost improved surfaces that must be maintained, strengthened, widened, to carry increasing traffic.

To do this job, a special group of machines and attachments have been developed.

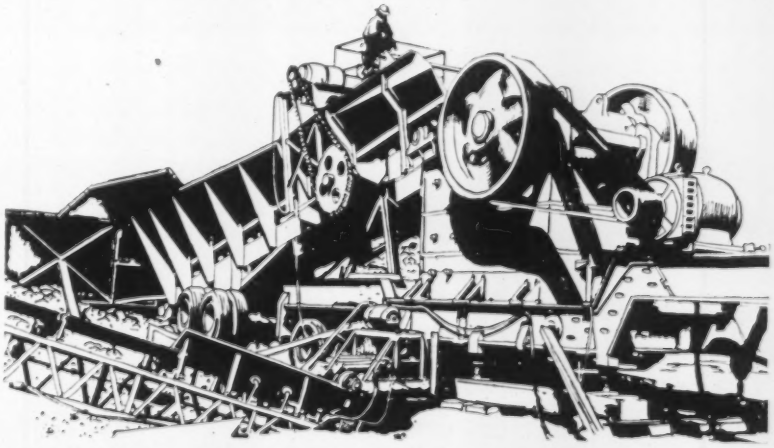
Most of this equipment is designed for mixed-in-place pavements, which require no sub-base or base preparation, and which require machines capable of handling a wide variety of soils and aggregates on the road, rather than after processing in a stationary plant.

One machine in this class, for instance, picks up aggregate from a windrow, mixes it with an appropriate binder, and deposits the resulting material behind it in windrows, or spreads it to a required thickness.

Another, more elaborate, usually follows a bucket loader, receives aggregate into a hopper, mixes with a binder, and spreads behind.

A third type—perhaps most popular, mixes aggregate and binder under a metal hood, without elevating the material from the ground. In this machine—if liquid binder is used—it can be sprayed directly into the mixing chamber. If the binder is a mineral (such as loam, dust or cement) the binder is first spread over the surface to be prepared, mixed as the machine passes over it.

And of course, the standard tools of the municipal highway maintenance crew—the grader, the small dump truck, the stockpile of ready-mixed materials, and the hand rakes, shovels, small compactors and rollers, hand tampers and the like, are always present in the inventory.



Portable feeding, crushing, and screening equipment allow contractor to shift operations quickly from job-site to job-site.

Miscellaneous Tools

Power Replaces Muscle

Then:

Construction work was manual labor—human and animal muscles supplied power on every job.

Now:

The workman is still very much present—but his muscles are supplemented by machines that do the work faster, better.

Nothing better demonstrates the American philosophy of doing more work with less men and less effort than the field of small tools. And nothing so pleases the heart of the U. S. craftsman—amateur or professional—than the small, incredibly rugged, extremely versatile machines that have been developed to increase the skill and power of his hands.

Not much historical background is needed for understanding here. The ingenuity which invented the cotton gin and the constant search for labor saving are the spur behind the development of the tools. And, as in much larger machines, of course, developments in metals, lubrication, power units have contributed heavily to the qualities available at the flick of a switch.

None of these small tools is in the exclusive domain of the highway contractor—their very versatility insures that they will appear and reappear in every form of construction.

Power sources

You can make a logical beginning in a bewildering field by starting with the sources of power used. And that immediately brings into the picture the ubiquitous small gasoline engines, which can be found noisily put-putting away on any construction job, busily supplying standby electric power, driving small compressors, powering small concrete mixers, vibrators and the like, driving pumps of both centrifugal and diaphragm types, driving motorized buggies and other equipment.

Manufacturers turn out these little engines by the hundreds with horsepower ratings running from less than 1 hp up to about 6. One cylinder, in most cases started by a pull-rope, the little machines are amazingly rugged and because of their simple construction, seemingly can run efficiently under the most adverse conditions, with a bare minimum of attention. All are air-cooled, use finned cylinders and heads—most often of cast aluminum—and are readily repaired with almost no other tools than screwdrivers and pliers. Usually built to drive other equipment—such as small concrete mixers—through belting, they can also be converted to direct and gear drives.

Heavier engines—such as those made for portable standby power plants and compressors—run into much greater horsepowers, of course, and really heavy ones are diesel powered.

The word portable, of course, can be stretched considerably. The little gas engines may weigh anywhere from 20 to 70 lb, and are easily transportable by hand. Some travel on wheels or specially built wheeled carts.

Nevertheless, the availability, power, and stamina of the engines makes power—either air, electric, or direct drive—available to a contractor any place, regardless of location and proximity to more conventional sources.

Saws, drills, hammers

Universal to the construction industry are the power saws—table-type or hand-held, but in most cases electric powered. (Brush cutting and tree-cutting saws, however, carry their own gasoline engines—and the whole weight of engine and saw isn't difficult for one man to handle.)

But with greatly improved motors, and great improvements both in the metal and the setting of blade teeth, the saws are an essential tool for any formwork and for many other operations in roadbuilding.

Probably most versatile tool in the small-tool category is the powered drill; taking bits from one-quarter to a full inch. With its many attachments, this machine can drill holes in wood, stone and steel; become a saw for light cutting; be used as a buffer, grinder and polisher; drive screws and bolts; can supply power for some kinds of vibrators, and for various grinding, and teeth and bit sharpening devices.

In this same category fall a family of other tools—though some of them are specialized to such an extent that they won't be considered separately here. But to be included are such items as the powder-actuated guns for setting studs and other devices into concrete and metal; the air-power wrenches and augers; welding equipment of all types; clay knives or clay spades for excavation work; saws for cutting concrete and stone.

Pumps

Of special interest to the highway builder are the pumps most highway jobs seem to require—for bailing out ground water or heavy rainfalls, for drying—and keeping dry—excavations, and for many other purposes.

Much has happened to the pump since the first bucket was dropped into the first well or pond, and much is still happening. Primarily, what happened has been the application of power to the operation, reduction in size, and the development of two high capacity types: The diaphragm and impeller (or centrifugal) pump.

In thumbnail, the diaphragm pump, by positive action of a tightly-sealed piston, creates a vacuum that sucks up water and air from the reservoir and discharges it. The centrifugal pump creates a vacuum that draws in the water by the spinning of vanes on an impeller.

The diaphragm pump will work without priming—filling the chamber with water or other liquid to provide a perfect seal so that the vacuum principle can work—but it works better and more quickly if it is primed. The centrifugal type won't work without priming. Development of self-priming attachments—basically a water reservoir that is refilled by the pump once it begins to operate—have vastly increased the efficiency of the units.

Capacities are high on both types—running from as much as 65 gpm (at 15-ft head) for a 2 hp unit up to more than 2,100 gpm with a 42 hp engine. (With greater horsepower, bigger pumps can reach into the 200,000 gpm class). Rugged and built for trouble-free operation, the pumps can be pushed, towed or carried to almost any location, operate independently of any other source of power but their own engines, and pump amazing con-

Stud driver, powered by explosives, anchors decking, wall panels, and numerous other materials.

Two-way radio brings all parts of highway job in close communication.

glomerations of earth, sand, clay and organic material along with the water, without apparent damage to themselves.

Vibrators

To make sure that concrete fills all the space within a form, and to meet low-slump specification requirements, contractors on every form of construction have made increasing use of vibrators. More, they've discovered that the little "wigglers" can also be used to move considerable quantities of dry material—like stockpiled sand and gravel—without the aid of muscles.

Essentially, the vibration is applied in the small head of the machine by one of two means: An eccentric gear which throws weights to one side or the other, creating a rapid wiggling motion in the flexible head; or by a ball, pushed by air pressure, running at great speed within a raceway. Various types of heads and weights being available, depending on the material to be vibrated—in light material, some of the machines can attain as many as 12,000 oscillations per min.

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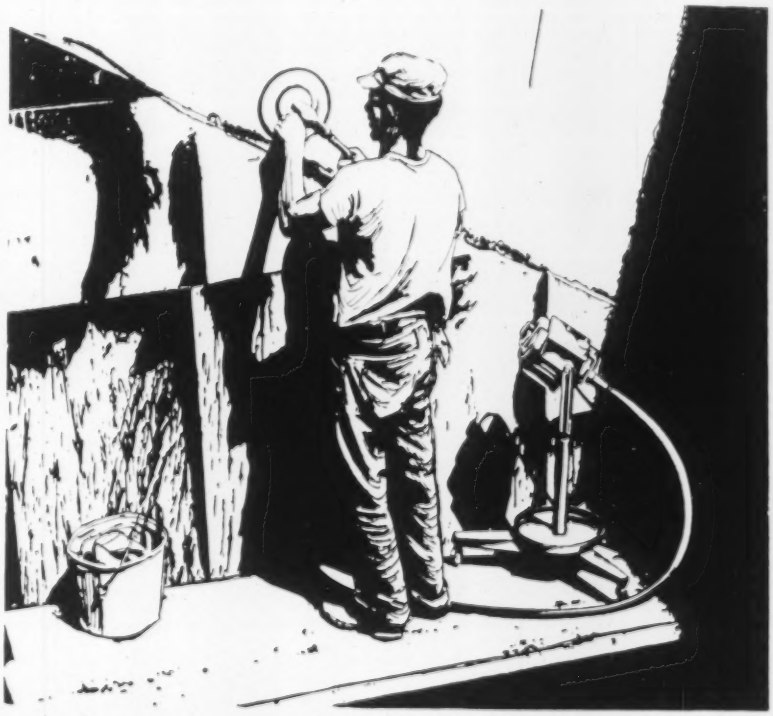

Concrete grinding machine is powered electrically through a flexible shaft. It's faster and cheaper than hand rubbing.

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Electric vibrator is lowered into foundation form to help consolidate concrete.

Reciprocating saw, powered by gasoline engine, quickly slices through plank. Lightweight unit boosts man's daily production.

Power drill accurately cuts deep holes in concrete wall.

ing) have been carried, of course, to much larger machines than the hand-operated ones. Some of these can vibrate the full 13-ft or more width of a concrete slab at one time.

Other units

The list of other smaller equipment that can be adapted to the use of the roadbuilder is almost endless. It should certainly include "packaged weather" units to provide up to 300,000 btu per hour of heat to keep engines from freezing, keep isolated workshops at comfortable temperatures; cleaning and washing appartus, and a whole host of machines for maintenance purposes.

And certainly, also there should be included some consideration of radio communications which make it possible for one man to supervise several miles of construction work, travel the job, and never be out of touch.

What's ahead?—As in all other categories, the main thing that's ahead for these tools can be listed quickly:

Greater versatility; more and more power in smaller packages; better materials for longer-lasting machines; more and more independence of outside or fixed power sources.

Impact wrench is ideal for turning up studs in engine block.

Pneumatic device breaks tire bead from steel rim. Many tire tools are available.

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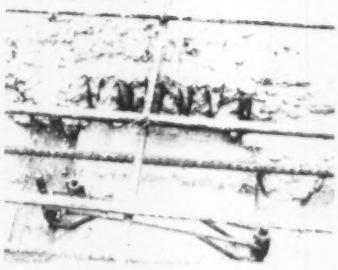
NAME

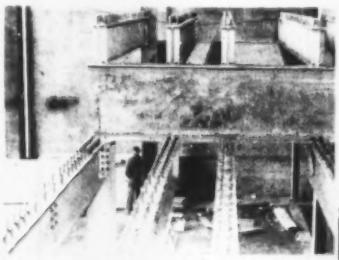
COMPANY

ADDRESS

CITY STATE



Excellent compaction of concrete around Nelson Studs is shown on bridge at Pierre, S. D. Designed by K. R. Scurr. Shop fabricated by Egger-Scudder Co., Sioux Falls, S. D.



With Nelson Shear Connector Studs, building designers are making concrete serve double duty. Tying concrete to steel increases load carrying capacity, gives greater rigidity, reduces size of beams.

Bridge at Donaldsonville, Georgia. Designed by Bridge Department, State of Georgia. Nelson Studs installed in the field by Scott Construction Co., Thomasville, Ga.

NELWELD

SHEAR CONNECTOR STUDS AT WORK ON COMPOSITE STRUCTURES

End-welded shear connectors, pioneered by NELSON, are gaining wide acceptance among builders of low-cost composite concrete-and-steel bridges and buildings.

Engineers like them for simplicity of design, better compaction of concrete, and lack of distortion. Contractors and fabricators benefit from speed of application, economy, and greater safety.

Technical and application data are available. Write on your letterhead.

NELSON STUD WELDING

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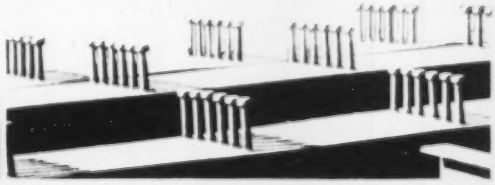
LORAIN, OHIO



Macks ARE HANDLING THE IMPORTANT JOBS

building the National Highway System!

The road boom's underway! Up to 33 billion dollars worth of new highways to be built. And right now, you're probably asking yourself:

"What kind of hauling equipment will net me the greatest return?"

For the best answer . . . ask any of the thousands of construction firms that have learned to rely on Macks. They'll tell you that their best investment is the kind of equipment that can handle the most punishing loads over the worst terrain and footing without losing precious contract hours for overhaul or repair.

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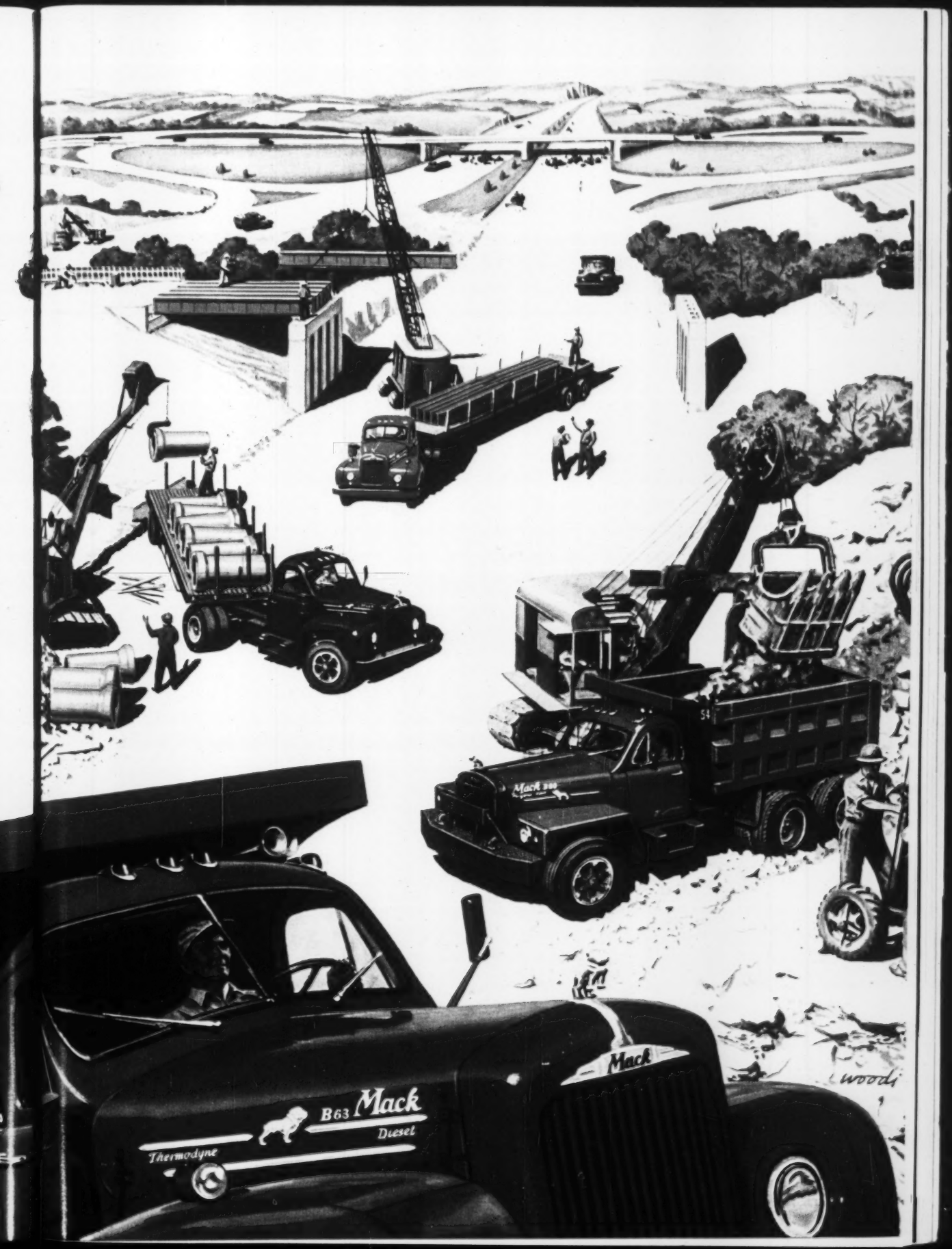
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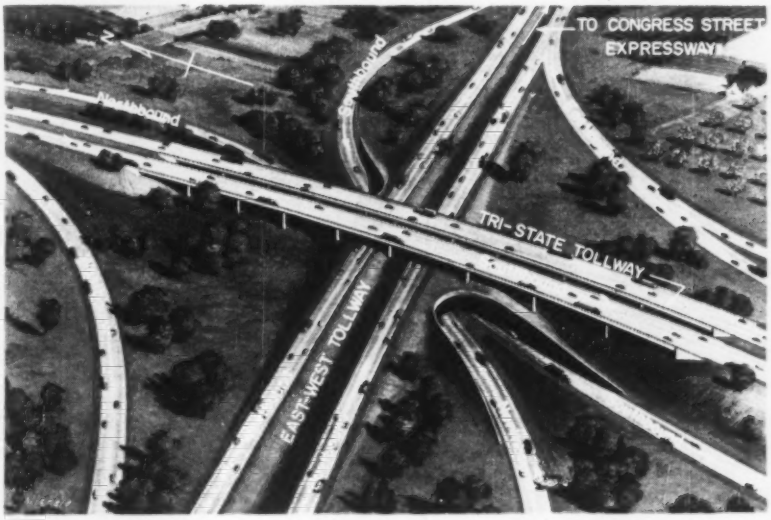

Tri-level Grade Separation Saves Space, Money, Homes

Interchange connections between interstate and other multilane highways generally require considerable area. Since the size of such areas increase with the complexity of the interchanges, a point is reached where ground-saving is of paramount importance.

This is especially true where real estate values are high. In those cases, three-level and even four-level grade separation structures offer the best solutions since they can utilize vertical area, with a corresponding reduction of horizontal area.

Two such complex interchanges are being designed for the Illinois State Toll Highway Commission. Each employs a three-level grade separation structure. When completed, they should offer solutions to some of the complex problems confronting engineers designing similar structures for our network of interstate highways.

One of the interchanges (shown above) will connect the 80-mile, $190-million Tri-State tollway encircling Chicago, with the 25-mile, $35 million East-West tollway extending from the west end of the Congress Street Expressway to Aurora. The other interchange will be at the junction of the Tri-State route with the 88-mile, $125 million North Illinois tollway to Rockford and north to the Wisconsin state line.

By using the three-level grade separation structure at the Tri-State–East-West interchange, design engineers were able to save considerable acreage. In fact, they reduced the amount of land originally estimated for the interchange by about 80 acres. Moreover, they saved the necessity of moving 125 homes from the right-of-way.

The three-level interchange will permit a high speed flow of traffic between the two tollways, with an estimated capacity of 4,000 vehicles per hour. The top roadway of the structure will carry northbound and southbound traffic of the six-lane Tri-State tollway over the four-lane East-West tollway, which will be on the second level. Gradually curving ramps will sweep under both tollways on the lowest level. They will enable eastbound vehicles from the East-West route to move north on the Tri-State; also westbound vehicles from the Congress Street expressway to go south on the Tri-State.

The lower level of the three-level structure is unusual in that traffic will move on a "left-hand" basis, with the two ramps separated by a barrier.

Additional ramps will permit northbound or southbound traffic on the Tri-State route to move west on the East-West route or east on Congress Street; also Congress Street traffic to go north on Tri-State, and East-West vehicles to move south on the Tri-State tollway.

The engineering firm of E. Lionel Pavlo is in charge of the design section embracing the three-level structure for the Tri-State–East-West interchange. Joseph K. Knoerle & Associates, Inc., are general consultants on the 195-mile $415 million project.

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Interstate Highway File:

Construction

Soil-cement mixed in a central plant and placed by . . .

Asphaltic concrete, also plant-mixed (above) and . . .

placed with a bituminous paver, are ke to

Speedy Work on the Spokane Freeway

Eastern Washington's first full freeway was opened for traffic at Spokane in November. Helping to speed completion before winter weather made construction difficult was a 6-in. plant-mixed soil-cement base that was placed in 19 work days on a 5-mi stretch of 24-ft separated roadways. Paving with asphaltic concrete followed close behind the base work.

The completed portion of the new freeway extends east from the Spokane city limits. It is part of U. S. 10 which is on the federal interstate system, and although programed before the new federal act was passed, the freeway will meet the federal interstate standards. Other work is programed to extend the freeway an additional 6 mi east. Ultimately, it will extend to the Idaho border, 18 mi east of Spokane.

The freeway includes two 24-ft wide pavements capable of handling two traffic lanes each. There is a 36 to 40-ft division between traffic pavements. And in each direction there is a 4-ft shoulder on the inside plus a 10-ft shoulder on the outside. The pavement includes a 2-in. thick stone surfacing top course on the gravel subgrade. This is topped with a 6-in. cement-treated base layer that is 25 ft wide. Final surfacing is 3 in. of asphaltic concrete laid in 2 layers, each 1½ in. thick. Shoulders are surfaced with stone chips bound by a seal coat.

The program was justified on an estimate of 18,800 cars a day in 1975 at the eastern city limits. The first 11 mi goes through a highly developed industrial area that contributes a substantial amount of traffic. At the eastern end of this 11-mi stretch the 1975 traffic is estimated at being 8,850 cars a day.

Total cost of the freeway from Spokane to the Idaho state line is estimated at $11.4 million. This includes right-of-way. To date, some $3 million has been spent or obligated in construction contracts. This includes 22 separate contracts.

Reason for the large number of contracts is that the Washington Highway Department has a general policy of separating structures from grading work. And often grading and paving are handled as separate contracts. One reason for this is to encourage wide-spread bidding by keeping the size of the job within reach of many contractors. And the jobs generally cover just one season's work which removes many of the uncertainties for the contractors.

Biggest contract to date is a 5.1-mi surfacing and paving job, bid at $705,019 by McAree & Heathe, Inc. and E. R. Hewett Co., a joint venture. This job includes cement-treated base, asphaltic concrete surfacing, curbs, gutters, guard rail and illumination. The cement-treated base is the most unusual feature because of its preparation in a central plant.

• Plant mix chosen—The job specifications permitted the contractor to choose between central mixing or road mixing for the soil-cement work. The joint venture selected the plant-mix operation. In addition to providing a close check on quality and quantities, the

truck-fed, tractor-pusned spreader provide base course for . . .

are ke to . . . .

plant-mix operation permitted starting or stopping the work whenever weather or work shifts indicated it was necessary or desirable.

The contractor is not yet in a position to state whether the plant-mix operation was more economical than a mixed-in-place operation would have been. Indications are that the plant mix work was slightly more expensive.

Major quantities involved in the cement-treated base work include 40,340 tons of cement-treated base aggregate bid at $0.95 a ton, 9,870 tons of special blending sand bid at $2.15 a ton, 11,050 bbl portland cement bid at $4.95 a barrel, 154,000 sq yd of mixing and placing cement-treated base bid at $0.19 a square yard, and 160 tons of emulsified asphalt curing coat bid at $75.50 a ton. The job also includes 31,930 tons of Class B asphaltic concrete bid at $5.80 a ton.

• **Pugmill mixes soil-cement**—The central plant for mixing the cement-treated base centers around a pugmill that provides continuous mixing of the material. This installation has a set of shaft-mounted paddles. The paddles are so inclined as to push the mixture through for continuous operation. Mixing time is one minute.

The pugmill is fed by conveyor belts running from two aggregate stockpiles. Cement comes from an adjacent silo. Gates for sand, aggregate and cement are calibrated in pounds per minute for quantity control. Water was added in the pug mill by three spray bars, with the quantity checked by a water meter.

The aggregate was 2 in. nominal maximum size and comes from locally available supplies. But these supplies are deficient in fines and blending sand must be added.

The job requirements call for the aggregate to meet these standards:

Sieve Size	% Passing
1"	100
3/4"	90 to 100
3/8"	65 to 90
No. 4	50 to 80
#4	40 to 75
#10	30 to 60
#40	13 to 36
#200	3 to 15

The soil-cement mixture has 4% cement and 6% water by weight. Specifications required the base to reach 650 psi strength in seven days. Tests on cylinders ran as high as 1,200 psi.

The contractor worked the plant on a 9-hr shift. This meant that placing operations usually ran for an 11 hour period during the 19 days of base placing. The plant was capable of producing 450 tons per hour, but operated at a 300-ton-per-hour rate.

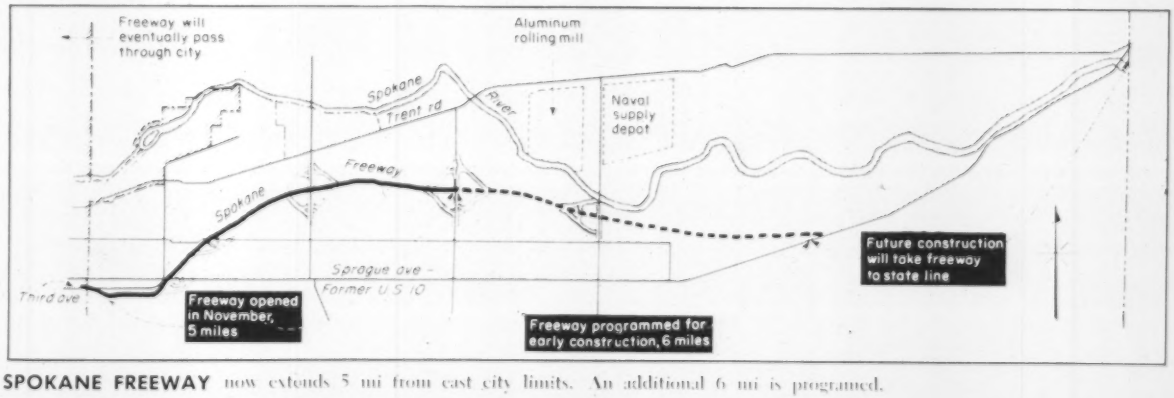
• **Soil-Cement placing**—Material was trucked from the plant to the roadway, with four to nine trucks used depending on length of haul. The base material was spread by a tractor-pushed spreader that laid a 12½ ft width. The mix was placed 7 in. thick so that compacted thickness would be 6 in.

First step in compaction was a pass by a vibratory compactor. Then came a motor grader that skimmed off the top half inch of thickness in one pass and replaced it in another pass in order to remove the irregularities developed by the placing and compacting equipment. When necessary, this was followed by a fog-type water spray. Then came a tandem roller.

The final step in placing soil-cement base was the application of a curing coat of emulsified asphalt spread at the rate of 0.15 gal per square yard.

The entire operation took a crew of from 16 to 22 men. This included 4 or 5 men for the central mixing plant.

There was some degree of urgency in the placing work since the specifications required that the base be in place and



SPOKANE FREEWAY now extends 5 mi from east city limits. An additional 6 mi is programed.

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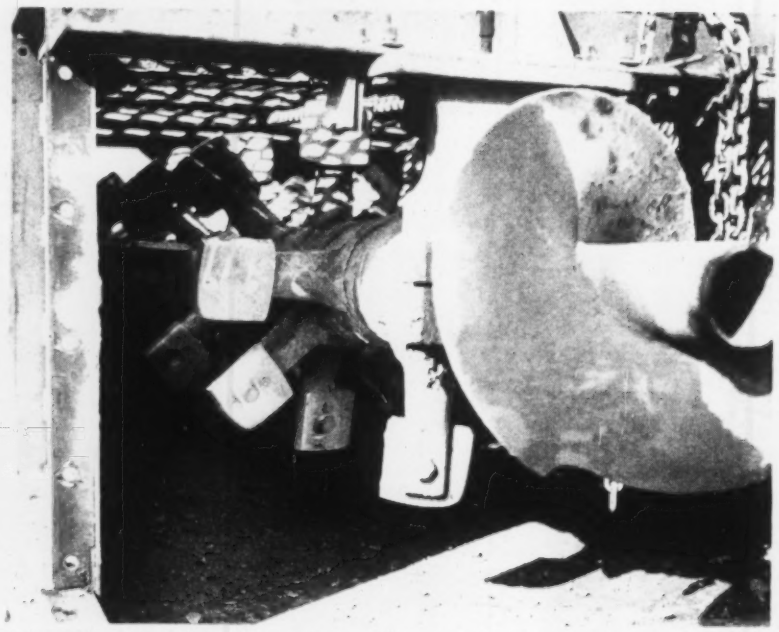
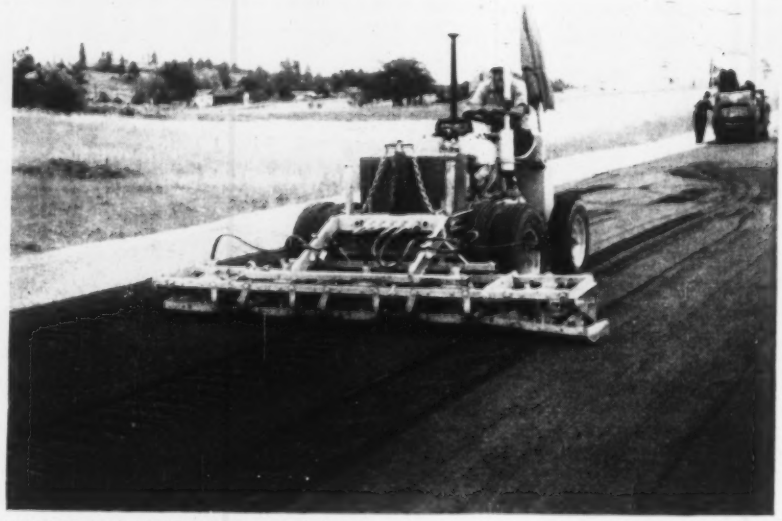
Spokane Freeway Moves Fast



PUG MILL PADDLES mix cement-treated base material. Spokane Freeway is first western use of plant mix for cement-treated base.



VIBRATORY COMPACTOR was first step in consolidating the base course. This was followed by motor patrol and tandem roller.

rolled out within two hours from the time water was added in the pug mill.

The contractor generally placed 400 ft one lane at a time. In this way the work could be stopped with little difficulty. This contrasts with a road mix operation where a substantial length of base course is usually in process at one time.

• **Credits**—The Spokane Freeway is a project of the Washington Department of Highways. W. A. Bugge, director. R. Ross is district engineer and B. L. Huffman is district construction engineer. R. B. Leary was resident engineer on the grading and paving contracts. Paul Carnine was resident engineer on bridge construction. Representing the joint venture on the work as superintendent was Harold Hancke of L. R. Hewett Co. and as spreading foreman was David Hennbigner of McAtee & Heatlie, Inc.

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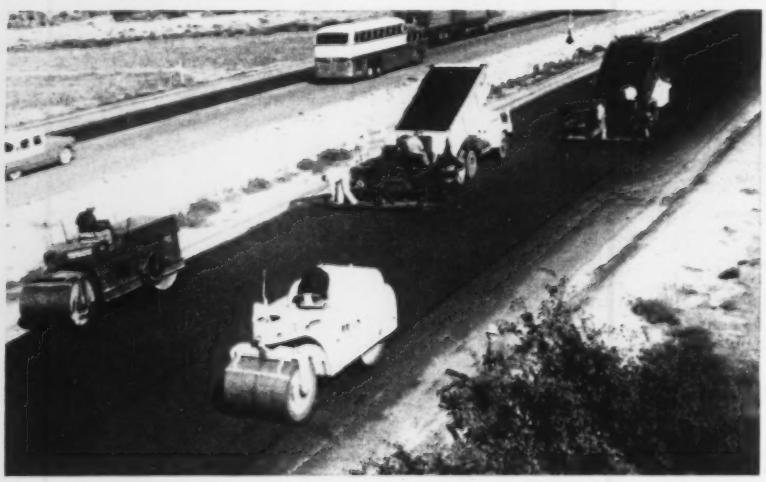
Slurry Sealing ahead of resurfacing as . . .

Bitumuls and Asphalt Put New Life in Famous Ridge Route on U. S. Highway 99

On a 41 mile stretch of the Ridge Route, (U. S. Highway 99), between Los Angeles, California, and the Kern County line, heavy auto, bus and truck traffic had caused serious deterioration of various sections of old pavement. So the California Division of Highways called for bids by June 21, 1956, for one of the largest resurfacing contracts ever let.

The job called for a total of 21 miles of multi-lane asphaltic concrete resurfacing; 13 miles of sub-sealing, crack-sealing, and priming of old rigid-type pavement ahead of resurfacing; 8 miles of sealing and priming existing bituminous four-lane divided roadway; and extensive shoulder work. Total estimated cost was over one-half million dollars.



A 3" ASPHALTIC CONCRETE COURSE of 200-300 Penetration asphalt, ½" to ¾" maximum-size aggregate, was used to restore riding qualities to old, rigid-type, three-lane pavement now serving as one-half the roadway on 13 miles of U. S. Highway 99.

Contract awarded—Successful bidder on the job was Schroeder & Co., Sun Valley, California. Completion was scheduled for January, 1957, so work began immediately. At a central site on the job, aggregate production and plant-mixing equipment was set up. Carefully-calculated Bitumuls and asphalt requirements were reviewed with the Field Engineers of American Bitumuls & Asphalt Co., and a precise delivery time-table was drawn up to keep all phases on the job moving.

Asphalt & Bitumuls big items—The quantities of asphalt and Bitumuls required are impressive: for sub-sealing, 1700 tons of Grade 10-25 Air Refined Asphalt; for resurfacing, 3500 tons of 200-300 Penetration Paving Asphalt; for seal and prime work, 140,000 gal. of Bitumuls.

Resurfacing rigid-type pavement—Here's how the job progressed: on the old rigid-type pavement, slabs were drilled and sub-sealed with air-refined asphalt. Then the cracks and joints were filled with either Bitumuls Slurry Seal, or a joint-sealing compound, or a combination of both.

Asphaltic concrete (Paving Asphalt mixed with ½" to ¾" maximum-size aggregate) was then trucked from the

plant and spread in two lifts (a levelling course and a surface course) to provide a uniform 3" thickness. Using two spreaders, each equipped with special shoulder extensions, this mix was placed to a full width of *37 ft. in a single pass.* In this way, despite long hauls (some up to 30 miles), as much as 1200 tons of mix were placed in a single day.

Resurfacing bituminous paving – The existing bituminous pavement required only a 1" overlay of asphaltic concrete as opposed to the 3" specified for the rigid-type section. Ahead of the placement of this 1" thickness, Bitumuls Slurry Seal was used to seal and prime the old surface. (Bitumuls Slurry Seal is a mixture of Bitumuls Emulsified Asphalt, selected fine, sharp sand and or fine stone screenings, and sufficient water to produce a free-flowing slurry. Batched into a transit-mix truck, these materials are mixed en-route; discharged onto the pavement; applied at full lane-width by a squeegee-mounted spreader-box).

This job, because of its unusual size and many complexities, provides an excellent example of the ability of American Bitumuls & Asphalt Co. to deliver a full line of asphaltic products to meet every need; and to furnish the on-job field-service that can often mean the difference between profit and loss. Whether your next project is a resurfacing operation or new construction, it will pay you to check with our office nearest you for *all* your asphalt requirements.

American Bitumuls & Asphalt Company
200 Bush Street
San Francisco 20, Calif.

HOLES WERE DRILLED in the rigid-type pavement at minimum intervals of ten feet. Air-refined asphalt (Grade 10-25) was then pumped in at an average of 27 gal. per hole to sub-seal the pavement.

CONTRACTOR SET UP modern aggregate production and mix-plant equipment at a central location on the job. Nature of project still required hauls of up to 50 miles.

THIS PHOTO, taken on one of the largest resurfacing jobs ever let, shows (left to right): Neil Boles, Field Engineer, American Bitumuls & Asphalt Co.; Johnny Hayden, Estimator and General Sales Manager, Schroeder & Co.; Bob Norman, Inspector, California Division of Highways; Everett Lenart, Job Superintendent, Schroeder & Co.; Don Frischer, Resident Engineer, California Division of Highways; Herb Belford, Assistant District Engineer, California Division of Highways; H. E. "Red" Schroeder, President, Schroeder & Co.

See you at the Road Show, Chicago, January 28–February 2; Booths 81-82, Materials and Supplies Section.

Interstate Highway File:

- ☐ Prospects and Problems
- ☑ Design
- ☐ Construction
- ☐ Costs

J. C. Young
Interchange design is an art, not an exact science.

California Practice Probed for . . .

Latest Expert Thinking on Traffic In

All of the interstate system, to be built under the new federal-aid highway act, will be constructed to freeway standards. This means that traffic interchanges will be a vital necessity, and that this layout and design will assume almost over riding importance. Since the California Division of Highways has had long experience in freeway construction (there are 450 traffic interchanges on the California highway system). The views of two of the top officials of this organization were sought to pin down the latest thinking on the subject. Questions on geometric layout were directed to J. C. Young, engineer of design, and questions on structural design were asked of A. L. Elliott, bridge engineer—planning.

Geometric layout

Q. How important are traffic interchanges to freeways?
Mr. Young: Some of us highway engineers look at a freeway as simply a divided highway connecting traffic interchanges. Actually, the service a freeway renders is based on its traffic interchanges, and the success of a freeway is due to the care taken in their location and design.

Q. What is the most important aspect of a good interchange?
Mr. Young: There are two key factors. An interchange should turn an intersecting traffic movement into a merging movement. And this should be done so the major traffic movements have the shortest travel path.

Q. In California's long experience with interchanges, what is the most important lesson that has been learned?
Mr. Young: In our work with the Arroyo Seco Parkway—now called the Pasadena Freeway—and other early routes involving interchange design, we soon learned that extreme care must be taken in laying out acceleration and deceleration lanes. Many of the early on-ramps were too short to permit autos entering the freeway to blend easily into the fast-moving traffic stream. And, in some cases, short off-ramps leading to arterial stops backed traffic onto the freeway causing congestion. A longer off-ramp with no terminal stop sign would cure this condition.

Q. What is the optimum spacing between interchanges?
Mr. Young: There is no such thing. Interchanges must be put in to satisfy traffic needs and serve existing street patterns. Thus, there become very few firm rules, and interchange layout is more an art based on judgment than an exact science.

Q. But isn't there some minimum distance between points where traffic movements can change?
Mr. Young: Yes, the standards call for at least 1,000 ft between two separate freeway off-ramps. And they call for a minimum of 600 ft between forks on the collector road system. In other words, these distances are established to give the driver time to make decisions.

Q. How important are directional signs in interchange practice?
Mr. Young: We used to work up complete designs before even consulting our traffic department. Now the traffic department is called in at an early stage to see if an effective signing program can be adopted. Some interchange designs are changed as a result.

Q. Realizing that geometric design of an interchange depends on the intersection to be served, what general types of interchanges do you have available to use?
Mr. Young: There are four general types: These are the old standard clover leaf, the diamond, the directional type and the rotary interchange. The clover leaf carries traffic on a long movement, and we steer away from it where possible. But where it is indicated, we have improved on the old clover leaf design.

A. L. Elliott
Long flowing architectural lines are in keeping with high speed traffic.

ic Interchange Design

By having a collector road paralleling the freeway, we reduce points of traffic friction with the freeway from four to two. The directional type can have any number of variations and is one of the best to use. Our famous four-level grade separation in Los Angeles is a semi-directional type. And modifications of these general types have become to be known by some fascinating nicknames. For instance, a trumpet interchange is to a certain extent a single quadrant clover leaf. We also have double trumpet intersections, and a specific type of semi-directional interchange has been dubbed "jug handle". Diamond interchanges have been modified to inside diamonds and half inside diamonds. Patterns depend on traffic and location. Thus, not all movements can be made at all interchanges.

Q. How much do interchanges cost?
Mr. Young: The minimum is in the neighborhood of $150,000. Of course, the more complex they are the more they will cost. We are currently designing an interchange for an intersection of four freeways in Los Angeles (Golden State, Santa Ana, Olympic and a future freeway as yet unnamed). Construction cost alone on this may run as much as $7 million.

Q. Are there specific things that should be watched for in locating interchanges?
Mr. Young: One thing to avoid if possible is combining a railroad grade separation with an interchange. This becomes a very complicated problem, but is one that we must face time and again because so many of the highways that we are converting to freeways parallel railroads. Also, in congested areas it is best to keep a freeway interchange away from a street intersection. This is not always possible. We have one such interchange on the Harbor Freeway in Los Angeles.

Q. We understand that, in your capacity as chairman of the AASHO design committee, you recently conducted regional seminars in Portland, St. Louis, Pittsburgh and Atlanta on interchange practice. Through this very recent knowledge of work in other states, can you comment on interchange practice throughout the country?
Mr. Young: From my travels and by talking with and listening to almost 400 engineers from more than 40 states, I find that designs are generally quite good. In California we find that we learn something from almost every interchange that we build. Some states, which do not have extensive experience, are repeating mistakes that we have learned to avoid. Too short acceleration and deceleration lanes is a prime example.

Structural Design

Q. What type of structure does California generally use for interchanges?
Mr. Elliott: California has no standard-type structure. Selection depends on many things. For example, where we are bridging an existing roadway, ease and quickness of erection is an important factor. There, for example, we would use steel girders or precast, prestressed concrete girders. Also, contractors in some parts of the state have been able to develop techniques for doing certain work more cheaply. This is most evident in the Los Angeles area where we have found that reinforced concrete box girder construction has become even more economical than concrete I-beams. As a matter of fact, California probably builds more concrete box-girder interchange structures than any other type. Although most interchange spans are 70 to 80 ft, we have built box girders more than 130 ft in length. And where clearance is a problem, box girders can be kept to relatively shallow depth. A 60-ft span box girder would be on the order of 3½ ft deep.

Q. How much does architectural appearance have to do with your selection of structural-type?
Mr. Elliott: A great deal. In congested areas the clean lines of a box girder structure are much more preferable than a concrete I-beam structure. Out in the country, where appearance is not a factor and where contractor experience may not be developed, we would probably use a concrete I-beam structure. We attempt to steer clear of all unnecessary architectural treatment. We feel that a structure's appearance cannot be improved by hanging false do-dads on it. We try to give our structures a simple, efficient appearance so that they do not attract attention either by being too gaudy and fancy or by being clumsily plain or boxy. Long flowing clean lines are much more in keeping with today's high-speed traffic.

Q. Has the steel shortage had much impact on your structural work?
Mr. Elliott: Unfortunately, yes. We are using a lot more precast, prestressed concrete construction than we might if steel were readily available. And we are substituting other types of concrete designs in many instances.

Q. What can you say of the steel structures you are able to build?
Mr. Elliott: Our practice is to use welded beams—that is, beams made of welded plate. In this manner we can put steel where we want it. We can vary the section as stress requirements vary. It is much more economical than using rolled shapes. And our practice has been completely gotten away from riveted steel structures. We have made extensive use of steel structures in the San Francisco area because of ease of erection in congested districts. But along the seacoast or in industrial areas, where steel maintenance might be high, we would be more apt to use a concrete structure.

Q. The interstate standards call for 10-ft outside shoulders and 5-ft inside

(Fig. 3) FOUR QUADRANT CLOVER LEAF has collector roads to reduce points of friction with the freeway from four to two. (Bayshort Freeway at San Mateo)

(Fig. 4) DIAMOND INTERCHANGE is simplest type but is generally not used where cross traffic is intense. (Santa Ana Freeway southwest of Santa Ana)

shoulders on highways. To what degree does this apply to interchange structures?

Mr. Elliott: Where structures are 150 ft or less in length, bridges are built to full shoulder width. For longer structures, width is reduced to the actual traffic lanes to be served plus offsets on each side. But in really long structures our current thinking is to provide turn-outs for emergency parking at, say, 1,000-ft intervals. Where shoulders continue across a structure, we are thinking of making the shoulder area surface a different color or texture from the traffic lane surface. In this connection, it is possible to intermix concrete and asphalt pavement types, or even to color the roadway surface to help the drivers differentiate between through traffic lanes and ramps.

Q. When do you handle both traffic directions on one structure and when do you build separate structures?

Mr. Elliott: The traffic separation space on a structure is really waste space. It's a matter of the cost of the unused deck space weighed against the cost of two railings and the side forms. That means that where the dividing space is more than 6 or 7 ft, it's better to build two bridges, and since most freeways require wide dividing strips, we almost always build separate structures for traffic in each direction.

Q. When you are expanding a freeway from, say, two lanes in each direction to three lanes in each direction, how do you provide the additional traffic capacity on existing structures?

Mr. Elliott: For the most part, we are widening structures in place. This is usually done by adding an extra lane on the outside. But sometimes, in stage construction, space is left to add the additional lane on the inside.

Q. Some interchange structures are approached by fills and others by structural ramps. How do you decide which to use?

Mr. Elliott: Generally, it's cheaper to build a fill than it is a bridge. But poor foundation conditions may lead to structural approach ramps. And appearance or sight distance might have a lot to do with it. On complicated interchanges, excess use of fills might cause drivers to become confused because they lose orientation by not being able to see where they are going.

Q. What about span lengths?

Mr. Elliott: Generally, unless there is some special reason because of congestion or sight requirements, we place a column in the dividing strip. It's obviously cheaper to build a structure with two 70-ft spans than with one 140-ft span. We have found, with our high speed traffic and complicated crisscrossing of ramps and roadways, the simplest support is the best. It does not distract the drivers, and it does not obstruct their sight distance. This leads to single column bents which we use very extensively.

(Fig. 8) DIFFERENT INTERCHANGES . . . . Diamond pattern is followed by

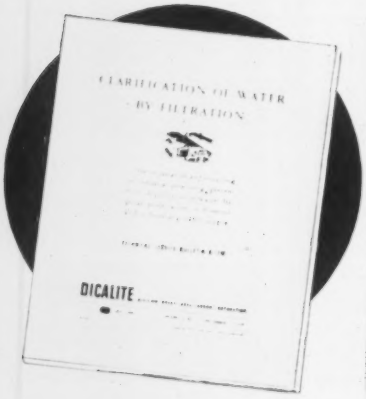
(Fig. 5) TRUMPET INTERCHANGE is used where most traffic originates on or is headed for one side of the freeway. (San Louis Obispo bypass freeway)

(Fig. 6) DOUBLE TRUMPET DESIGN (right) is a semi-directional type with completely separated traffic on ramp system. (Eastshore Freeway at Berkeley)

a trumpet interchange. (West Sacramento Freeway)

(Fig. 7) JUG HANDLE RAMPS guide traffic from one heavily traveled route to another. (Cabrillo Freeway and Mission Valley Road in San Diego)

(Fig. 9) INTERCHANGE AT STREET INTERSECTION should be used only where required by important controls. (Harbor Freeway at 23rd St.)



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Dual paving trains completed 8-mile section of 24-ft concrete pavement on US Highway 40 west of Topeka, Kan., on Nov. 14, making it the . . .

First Interstate Link Completed

An event of special significance to the Kansas Highway Commission and for the new national highway program occurred on Nov. 14. On that date, the first link in the 41,000-mile interstate highway system to be built under funds authorized by the 1956 Federal-Aid Highway Act was opened to traffic.

Although this is the first link finished, the job was not the first to be let to contract. This distinction belong to the Missouri Highway Department, which awarded a 13-mile section on U.S. Highway 66 in Ladede County on Aug. 2. Nevertheless the Kansas job, which was let on Sept. 6, is also believed to be first in starting actual paving, which began on Sept. 26.

The project is an 8-mile section of two-lane pavement on U.S. Highway 40, beginning 8 miles west of Topeka. Consisting of a concrete slab 24 ft wide and 9 in. thick, it is designed according to standards recently adopted for the interstate system to carry the heavy traffic loads forecast for 1975.

The two-lane pavement will serve two-way traffic for the present, but eventually will become part of a divided four-lane highway between Topeka and Junction City, 75 miles to the west. Construction of the additional two lanes is expected to get under way during 1957.

• **Wide median**—Looking ahead to forecasts of increased traffic volumes within the next decade or two, Kansas is providing a generous width of median strip for this first link in our highway network of the future. The highway act calls for a 56-ft minimum width median, but Kansas is providing for a 60-ft width, as a separation of the eventual two 24-ft pavements. This additional width of median will permit the construction of two additional inside lanes if and when they are needed to handle traffic in future years.

• **Contractors and contracts**—The 8-mile section of new pavement was built by Koss Construction Co., Pauline, Kan., under a $750,000 contract, using two pavers on the shoulders to place the full width and depth of slab in a continuous operation.

Grading and small drainage construction was performed by Grosshans-Peterson of Marysville, Kan., at a contract cost of $604,000. Four bridges in the 8-mile project were built by Russell Ralph, of Topeka, at a contract cost of $155,000; and Howard Veteto of Colony, Kan., had a $20,000 seeding contract.

Walter Johnson is state highway engineer and Frank E. Harwi, Jr., is director of the Kansas State Highway Commission. L. H. Vincent is division engineer of Division 1, with headquarters at Topeka. George Koss is president of the Koss Construction Co., and John Buerlein is manager of the company's Sunflower Branch, covering construction operations in Kansas.

In following this procedure, the state has fallen in line with a recent trend toward addition of added lanes on the inside, rather than the outside shoulders of its roads to provide less traffic interference.

*In the State of Washington heavy rainfall maintains a very high water table yet the Stang wellpoint installation and supervision kept a 6½-foot x 9-foot nearly vertical walled trench completely dry.

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This 150-foot by 400-foot drydock in Karachi, Pakistan, being built for the Pakistan Industrial Development Corp. (Swissboring Overseas Corp., Ltd., Contractor) called for an excavation 40 feet deep with a 32-foot water table—only 50 feet from the water's edge! Dewatering of the job was quickly and efficiently accomplished by a specially engineered installation of Stang wellpoints, supervised by a Stang field engineer. Just one more example of Stang's outstanding water handling services to contractors the world over.

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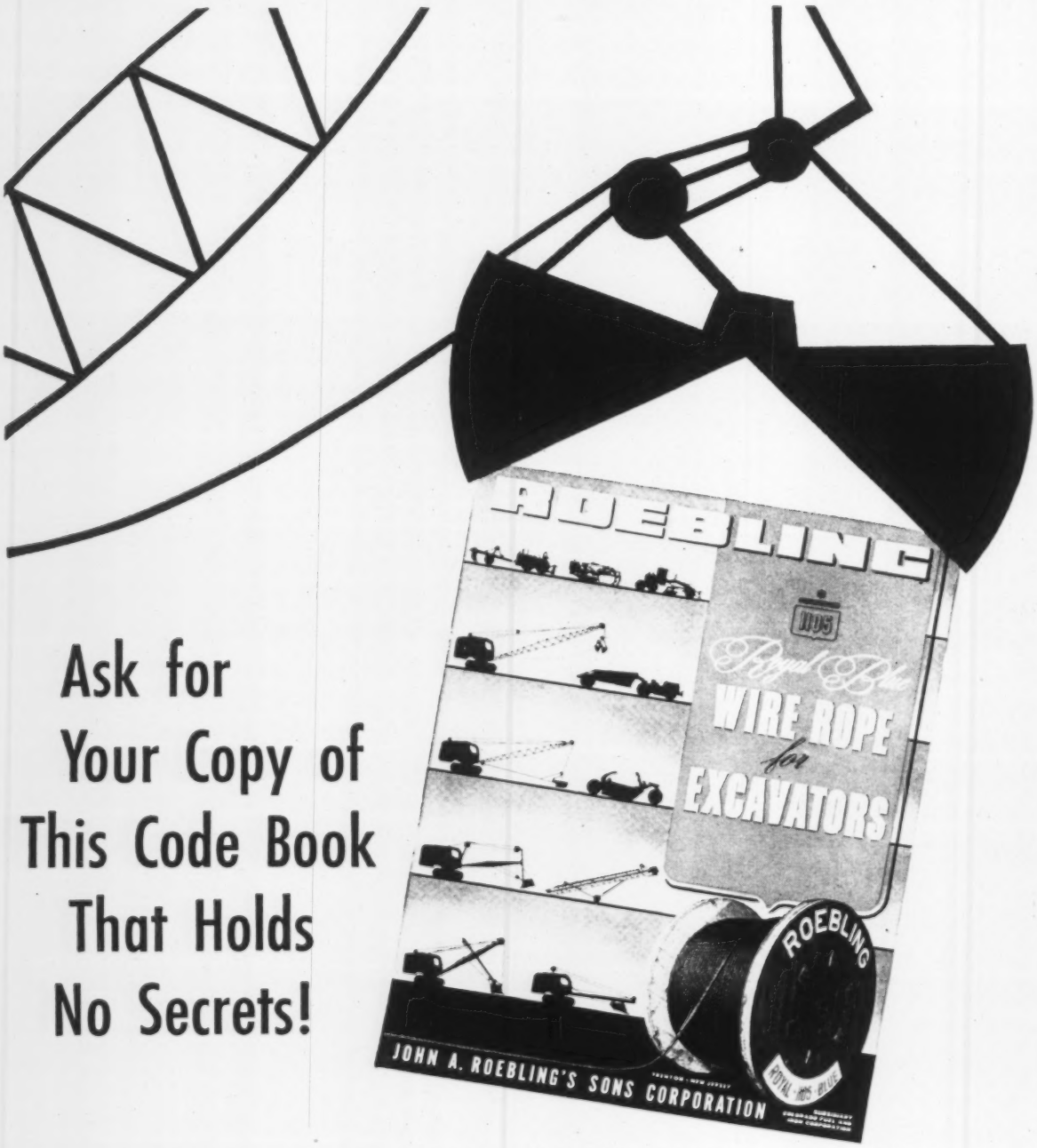

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You'll also find supplementary data on wire rope constructions, diameters, weights and breaking strengths.

There is a copy of this 12-page booklet waiting for you. Communicate with John A. Roebling's Sons Corporation, Trenton 2, New Jersey. Your copy will be sent promptly.

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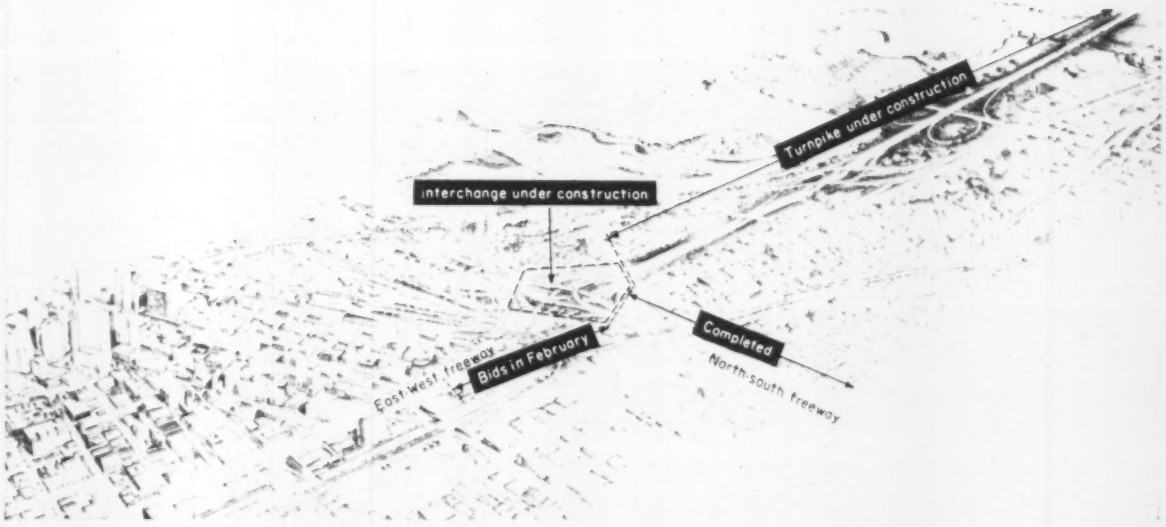

FORT WORTH—A four-level interchange in a compact layout connects turnpike and two intersecting freeways.

DALLAS—Interchange is a vast traffic distributor made up a road and viaduct net laid out in an old river bottom.

The Rural-Urban Interchange Problem

One of the most important problems in the development of an effective national highway network will be the planning and designing of traffic interchanges to get motor vehicles into, out of or around the cities on the system. Compared to the problem met at two intersecting rural roads, that of joining a rural road to an urban street system is vastly more complicated and costly. Not only must the designer cope with restricted areas (because of high right-of-way costs in developed areas) but not infrequently his interchange must be so arranged that it will guide motorists toward a number of different destinations instead of just affording them a turnoff to an intersecting road.

These problems of the rural-urban interchange are being solved in a notable manner in Dallas and Fort Worth, Tex., in connection with the toll turnpike being built between the two cities. As a result, in both cases, a motorist

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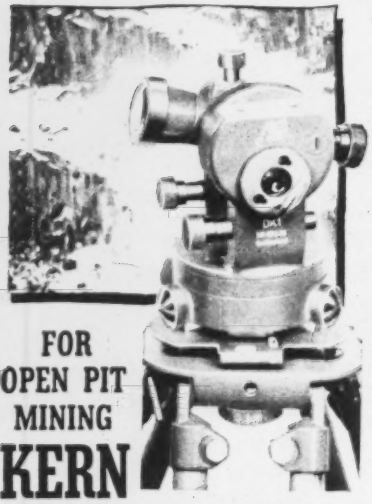

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FOREST OF BENTS for the viaducts of the turnpike terminal in Dallas stand ready for steel superstructure erection to begin.

will be able to reach the central business and hotel districts from the ends of the turnpike in the remarkable driving time of two minutes.

Involved in the design problem were the Texas Turnpike Authority's consulting engineers, Howard, Needles, Tammen & Bergendoff, Kansas City, Mo., the Texas State Highway Department, which has the responsibility for the urban portions, and the two city governments whose street systems are affected and served. The facilities are now under construction.

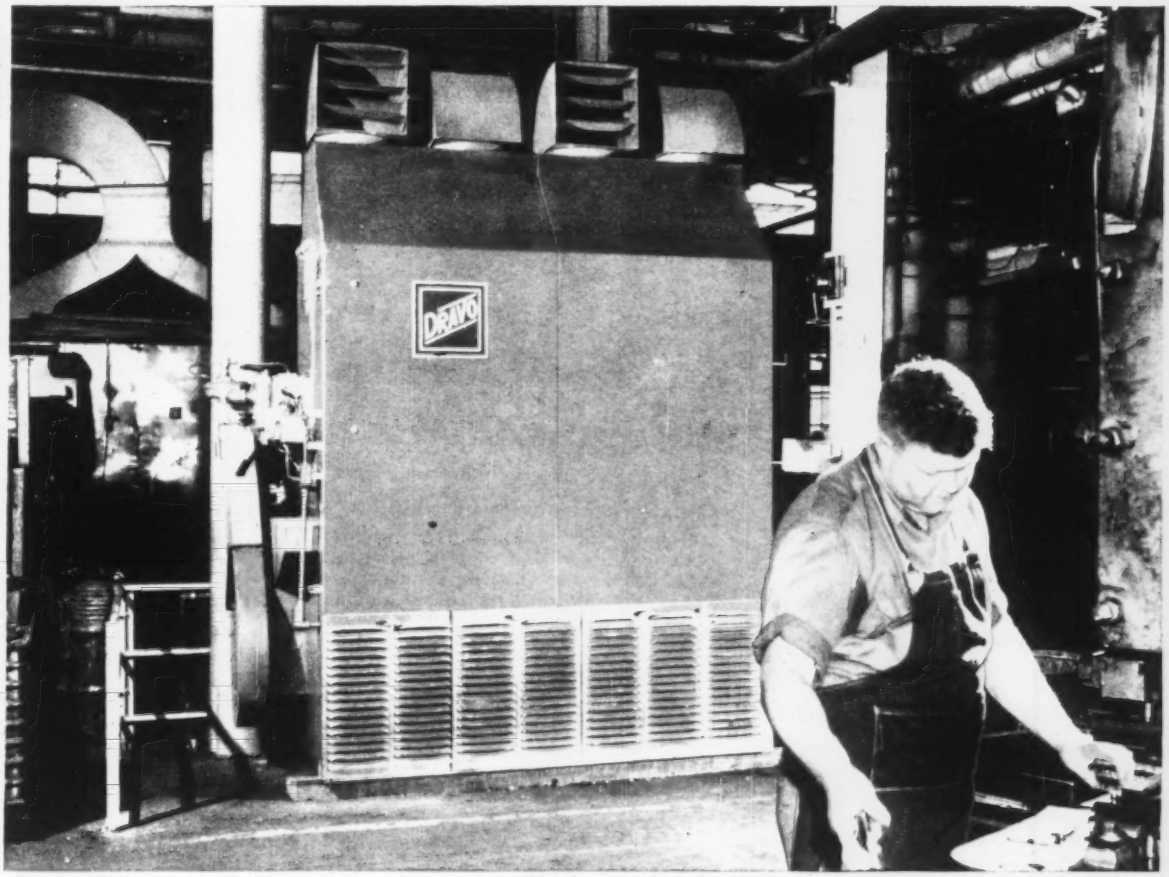
In Fort Worth, where the turnpike approaches the city from the east, the state and city engineers decided to prolong it straight across town on a new East-West Freeway, several blocks south of the central business section. Then, to provide outlets in the other directions, a new North-South Freeway was laid down immediately east of the business section. Where these new freeways intersect—and it is just beyond the terminus of the turnpike—an interchange had to be provided.

Although the interchange serves the intersection of only two main thoroughfares at right angles to one another, restricted space made a compact arrangement necessary, and a four-level directional type interchange is the result. The architectural drawing on the preceding page indicates the layout of the roadways, and the division of work between the Turnpike Authority and the Texas State Highway Department. The interchange structures are about half completed at present.

In Dallas, which the turnpike approaches from the west, old bottom lands of the Trinity River, protected by levees and reserved for industrial development were available along the west edge of the central business section of the city in which a spread-out interchange could be located. Whereas the Ft. Worth interchange had to be fitted to 25 acres, the Dallas layout could be spread over 57 acres.

Taking advantage of this situation, the Dallas planners laid out the series of roads, shown superimposed on the airview, over which the motorist can either enter or skirt the city. In effect the interchange forms an intersection for three main highways that traverse the city—US 67, northeast-southwest; US 77, northwest-south; and US 80, east-west, which to the west coincides with the turnpike. US 77 and US 80 are interstate highways.

Of the road net shown in the river bottom, the outside marginal roads between the T&PRR and Cadiz St. are under construction by the State Highway Department, while the construction of the viaducts at the end of the toll road and their approaches in the river bottom is the job of the Turnpike Authority. All of this work will be completed this summer, when the construction of the arms into and around the city will be put under contract by the State Highway Department.



DRAVO heaters save $11,000 annually—pay for themselves in 3 years

A cost study of heating systems at the Zanesville, Ohio, plant of Detroit Harvester Company indicated that Dravo forced air heaters would save $11,000 annually in fuel costs. At this rate, the heaters would pay for themselves in three years, also eliminate a major expenditure to extend and revamp an outgrown steam boiler system.

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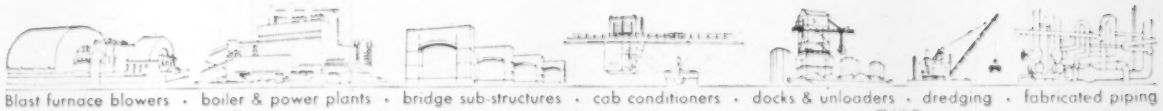

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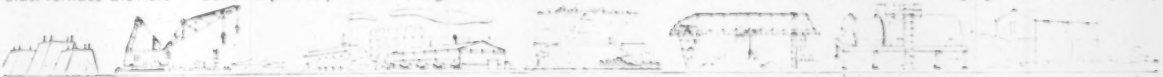

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More contractors use air tools to speed work, reduce costs

The country's leading contractors save time, save money, by making air do the work . . . letting men use their skills. Always searching for faster, more efficient, more economical construction equipment, they are making greater use of air tools today than ever before.

The widespread use of these tools, rugged in construction and excellent in performance, is taking much of the labor out of heavy construction work.

One man, with skilled handling of a clay digger, can do the work of a whole labor gang without becoming overtired — for modern equipment is air-cushioned to smooth out vibration. This removes the strain of handling that was associated with air tools of earlier design.

Using an air tool, the worker acquires the status of a skilled operator, taking pride in his work which is reflected in the general speed, efficiency, and progress of the contract.

Less fatigue — more work per man-hour

While it is accepted that wider use of air tools enables contractors to speed up work and reduce costs, it must be emphasized that care should be taken in the choice of equipment.

Certain features of air tools have a very direct bearing on the time/cost-saving factor. It is not simply a question of blows per minute; the degree of fatigue to which the worker is subjected greatly influences the progress he makes with the tool. *Air-cushioned* blows are of the first importance.

Always choose tools that have been specifically designed to reduce fatigue — you will obtain more work per man-hour and have a contented worker.

Other factors contributing to greater efficiency and output per man-hour

In addition to air-cushioning, the worker is relieved of much fatigue if the tool he is using is correctly balanced. This is of particular importance when working in cramped quarters, such as a trench, while using a clay digger.

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Le Roi Model 52 — Heavy duty Paving Breaker for [illegible] (55 lb.)

Le Roi Model C11 — General purpose Paving Breaker (53 lb.)

Le Roi Model C10 — Demolition, Light duty Paving Breaker (35 lb.)

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Le Roi Model C10D — [illegible] (35 lb.)

Le Roi Model TT11 — Tamper for all applications

Le Roi Model 22 — Sinker for utility work (37 lb.)

Le Roi Model 11 — Tamper for all applications

Le Roi Model H168 — Sinker for shallow drilling (35 lb.)

Paving breakers and drills should have the exhaust deflected away from the operator's legs. The sides of the tool should be streamlined and smooth for comfortable handling. Handgrips should remain cool, no matter how long the tool is in operation.

Sound design insures long life for tools

By the very nature of their operation, air tools are subjected to extreme and violent action. Rugged construction combined with precision engineering is essential if an air tool is to give long, efficient service with a minimum of maintenance.

Delays for unnecessary maintenance or the replacement of parts immediately affect the cost factor in relation to the contract as a whole. It pays to be sure that the tools chosen for the job match up to the following ideal standards:

Main components. The main parts of breakers, sinkers, tampers, etc., should be tough enough to stand up to the roughest use under all conditions. All parts should be heat-treated to the exact degree of hardness required for their specific purpose.

Auxiliary components. Tampers should have foil packing, clay spades an efficient bonded rubber and steel retainer. Breakers and drills should have a flow of air through the fronthead to prevent entry of dirt.

Wherever possible, bushings should be used to provide renewable wearing surfaces. On tools where these can easily be replaced, many years of life are added to the service of the equipment.

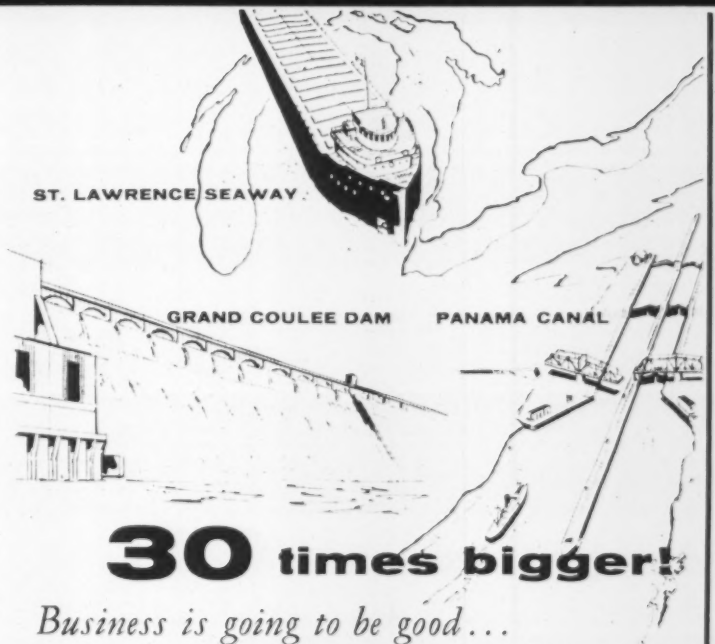
Lubrication system. The lubricating system must be efficient. Every tool should have positive shank oiling, and accurately metered oil to all moving parts.

General. Not only must the tool be balanced, and air-cushioned to assure the operator's comfort and convenience; it is equally important that the internal mechanism be finished to fine precision tolerances.

All mating surfaces should be lap-finished and leakproof to maintain perfect alignment with adjacent parts. Such minute tolerances result in less wastage of power, and lower air consumption. These factors add up to the ability to deliver smooth blows of greater power, with more comfort to the operator.

Service. All power tools, no matter how expertly manufactured, require replacement of component parts from time to time, usually due to excessive wear or mishandling.

To the busy contractor, any delay is costly, and no delay is more aggravating or needless than that caused by equipment out-of-service for lack of parts. Make certain that the manufacturer of the air tools you purchase maintains a really efficient, wide-spread service organization with well-stocked spare-parts distributors located to service your needs quickly.



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How the wise use of air tools can win more contracts for YOU

Take stock of your position today. Review your last few contracts, and answer these questions:

Am I using air power and air tools efficiently?

Would increased use of air tools have saved me time on my last job?

Would more air tools reduce the size of my working crews?

Am I using modern air tools?

Do I get good service on my air tools? Fast parts replacements?

Have I kept abreast of developments in air tools? Do I know what new ones have been introduced that I can use advantageously?

Would the increased use of air tools enable me to cut costs, and bid in lower against my competitors?

The smart contractor will make good use of the wide range of air tools available. He will utilize his manpower to skillfully handle labor-saving tools, thereby reducing labor overhead. He will seek tools and methods that will speed up the work. He will keep alert for new developments that will make airpower work for him more efficiently.

These are the airpower considerations that will place the wise contractor ahead of his competitors — that will give you an increased profit potential in every future contract.

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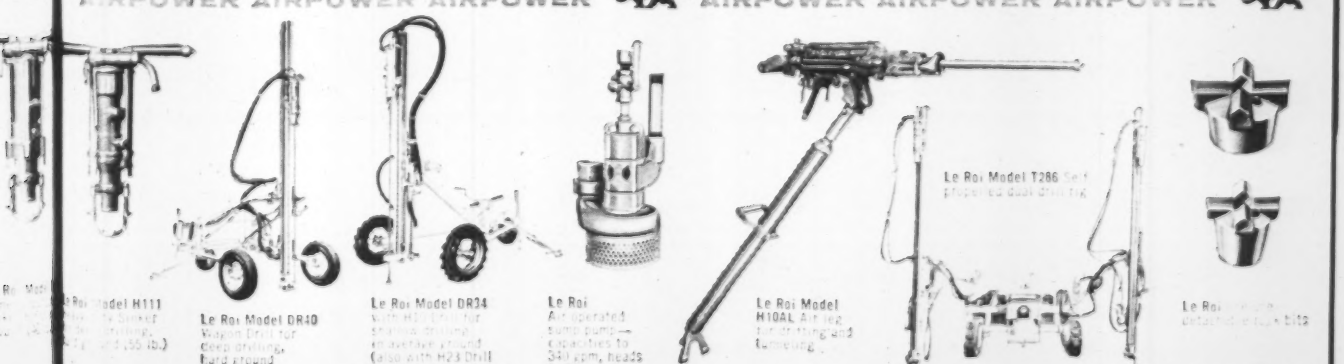
Le Roi Model DR40
Wagon Drill for deep drilling, hard ground
Le Roi Model DR34
(also with H23 Drill for medium drilling in hard ground.)
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Le Roi Model T286

(CONTINUED ON NEXT PAGE)

(CONTINUED FROM PRECEDING PAGE)

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You find all the important features for long life and top performance in Le Roi Newmatic Air tools and Equipment:

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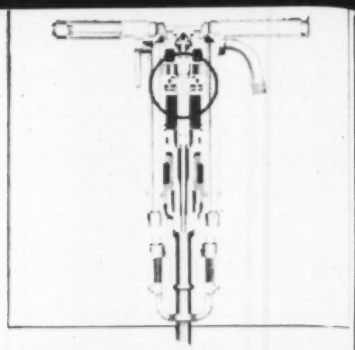
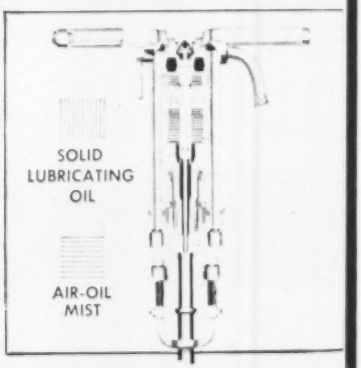
MODEL 52 LE ROI PAVING BREAKER makes light work of a tough combination of 4" asphalt and 6" concrete. Powered by the Le Roi Tractair, air tools make fast progress in street refinishing contract in Minneapolis. Scenes like this will be often repeated as the nation's road vehicles increase from today's 65 million to an estimated 92 million by 1971!

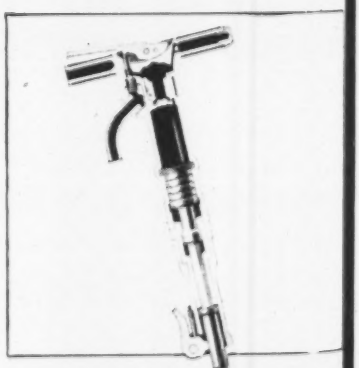


Snappy valve action on drills, breakers, spades, and tampers delivers air to the piston with split-second precision that makes smooth, powerful blows — and strong drill steel rotation.

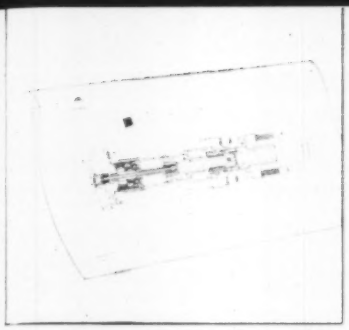
Every Le Roi Newmatic tool has an air cushion that smooths out vibrations. Because of extra bearing area for tappet support, chuck-bushing wear is reduced and the cushion is retained.



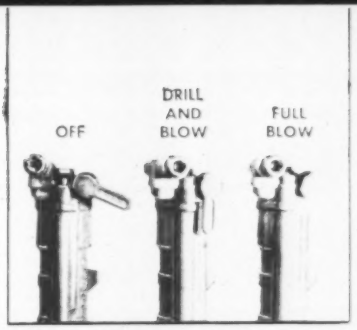
Le Roi Newmatic tools give you the extra-sure protection of a fool-proof lubrication system. Every tool has a large oil reservoir, positive shank oiling, and accurately metered oil to all moving parts.



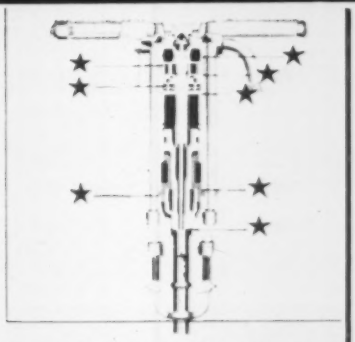
Bushings are used wherever possible to provide renewable wearing surfaces. Easily replaced, they add years to the life of your tools. Cylinder can be renewed by chrome plating at the factory.



Le Roi Newmatic drills get extra power from the minute tolerances observed in developing close but free piston-to-cylinder fit. There is less friction — less waste power due to leakage.



The throttle on Le Roi Newmatic sinkers controls both continuous blow-while-drilling, and full line pressure blow. It's easier to blow the hole frequently and obtain just the right cleaning for fastest drilling.



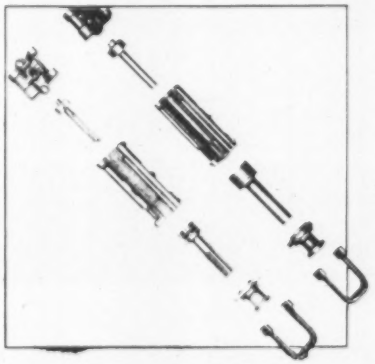
Mating surfaces in Le Roi Newmatic drills have lapped finishes that are leak-proof and maintain perfect alignment with adjoining parts. Result—smoother running, lower air consumption.

Balanced clay diggers and breakers give operators extra ease of handling—particularly when they are working in cramped quarters or with the tool above horizontal. The work is less tiring.

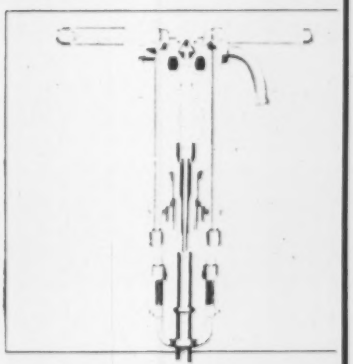
Exhaust from Le Roi Newmatic drills is deflected away from the operator's legs; the sides of the tools are smooth for more comfortable handling — easier use.

Le Roi Newmatic breakers and sinkers have rubber hand grips that stay cool even when the tool is used continuously for long periods. Latch-type retainers for breakers are another convenience.

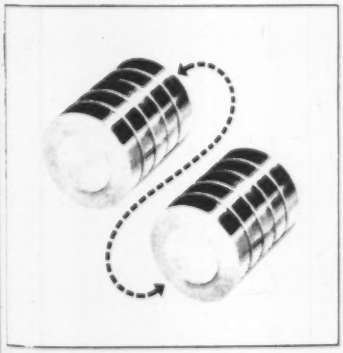
Tampers have foolproof foil packing, clay spades have the efficient bonded rubber and steel retainer, and breakers and drills have a flow of air through the fronthead to prevent entry of dirt.



Virtually indestructible forgings form the cylinders of Le Roi Newmatic breakers, sinkers, tampers, and clay spades. They have the toughness to resist the hard usage normally associated with rock drills.



Heat treatment of all parts to the exact degree of hardness and toughness required is a Le Roi Newmatic specialty. That's another reason why you can expect longer life from Le Roi tools.



Pistons in Le Roi Newmatic paving breakers are reversible — give you double life for the part and an extra saving in tool maintenance. It's another Le Roi Newmatic "extra-life" feature.

Le Roi Newmatic drills can put long service behind them without becoming "air hogs," because of the end-seating valve design that prevents loss of efficiency even after long usage.

Le Roi Newmatic distributors have ample spare-parts stocks on hand and men who "know rock drills" to service them. With their compressor-servicing facilities, they are your "air equipment headquarters."

(CONTINUED ON NEXT PAGE)

(CONTINUED FROM PRECEDING PAGE)

. . . here's where to go for LE ROI NEWMATIC AIR TOOLS

. . . the tools that are speeding work and cutting costs on major construction programs everywhere

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

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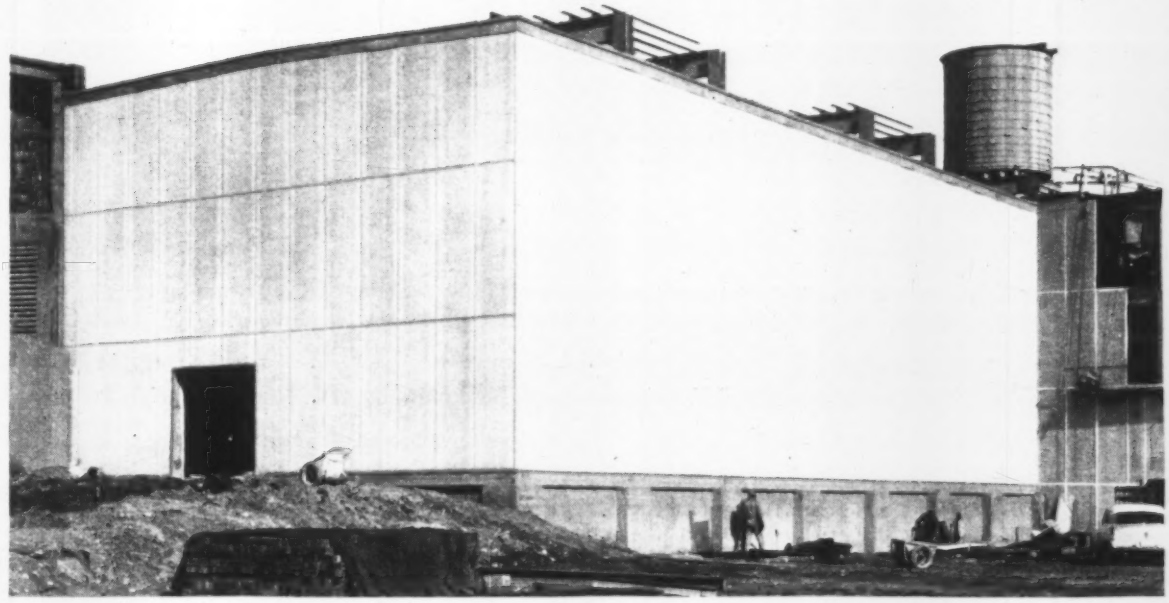
Maximum coverage...minimum erection cost...

Johns-Manville TRANSITOP® Structural Panels

Meet the trend to modern panelized construction



THE most striking change in building construction methods in recent years has been the trend toward prefabricated building panels.

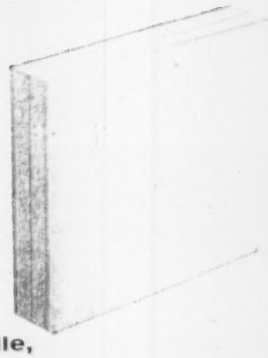
This is particularly true in the construction of panelized curtain walls for buildings, large and small. Although curtain wall construction in skyscrapers had been widely publicized, this method of construction is just as applicable to smaller buildings such as schools, hospitals, office buildings, motels and shopping centers. Today, paneled curtain walls probably exceed all other applications in popularity and are rapidly becoming the standard method of building construction.

Johns-Manville Transitop offers architects, designers and builders a simple and economical method of providing panelized curtain walls. Transitop is durable, weather resistant, requires minimum maintenance. As a curtain wall, Transitop provides high structural strength, reduces the dead load, increases usable floor space, provides adequate insulation and is easy to erect. Panels are easily applied over wood or steel framing.

The same advantages that make Transitop so suitable for panelized curtain wall construction also make it equally ideal for roof deck construction.

J-M Transitop is a complete 4′ wide by 8′, 9′, 10′ or 12′ long unit in 1 1 16″, 1 1 8″, 1 9 16″, or 2″ thicknesses. It consists of an integral impregnated insulating board core faced on two sides with Asbestos Flexboard sheets.

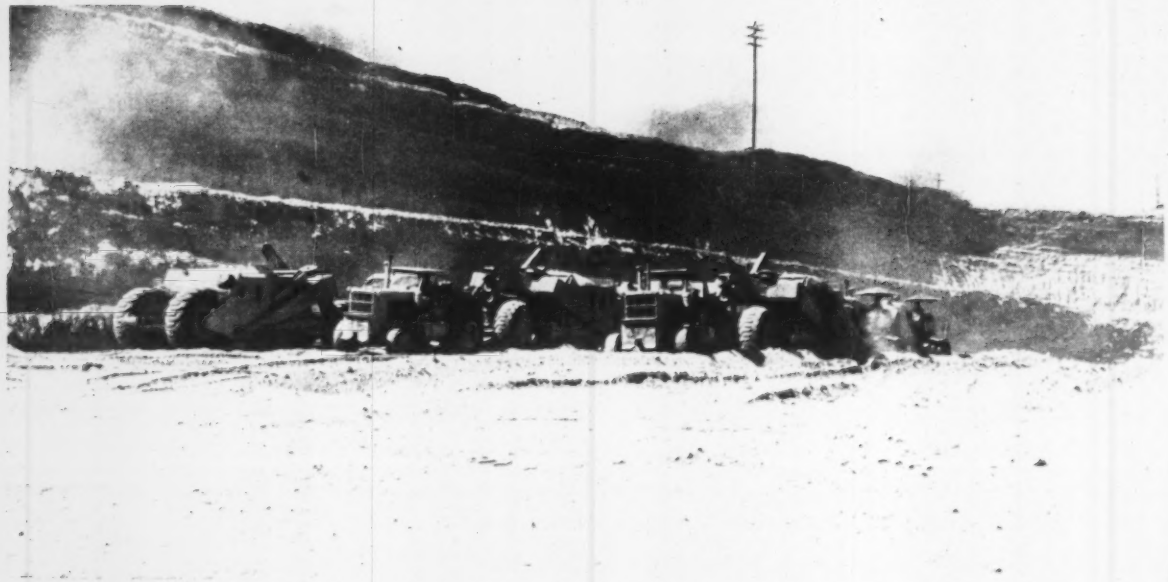
- Facings of tough, weatherproof asbestos-cement Flexboard
- Core of integrally impregnated insulating board
- Waterproof adhesive bonds core to Flexboard sheets
- Transitop is cut to fit and installed with ordinary construction tools



JOHNS-MANVILLE JM PRODUCTS

For information on Transitop, write Johns-Manville, Dept. EN, Box 158, New York 16, N. Y.

Johns-Manville Transitop



Part of the equipment used in the excavating operation at Pima Mine, Arizona. Operations will be completed about January, 1957.

STOODY HARD-FACING in one of the WORLD'S LARGEST OVERBURDEN STRIPPING PROJECTS

A huge stripping operation is in progress a few miles south of Tucson, Arizona, at the Pima Mine where Utah Construction Company is moving 6,000,000 cubic yards of overburden, including 600,000 yards of waste rock, to expose the copper ore deposit 210 feet below the surface. The job was begun in October of 1955 and will probably be completed by January of 1957.

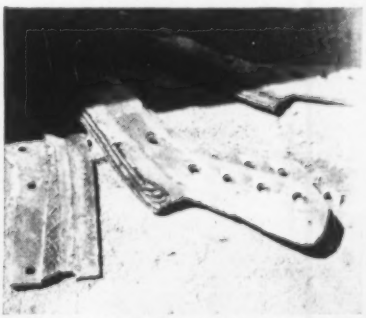
An unusual feature of this project is the method of moving the overburden, a highly abrasive alluvial soil. Instead of the usual blast hole equipment, shovels and dump trucks, the job is primarily handled with rippers and scrapers. After the rippers make a pass, scrapers pushed by crawlers pick up the loose material and haul it to a fill. The equipment inventory includes a D9 Cat ripper, an HD21 A-C ripper, 10 MRS scrapers, two Cat 12 motor graders, six A-C and two D9 Cat pushers, four LLD 30-yard trucks, a Marion 7-yard shovel, a Michigan dozer and two water wagons.

One out of three shifts is devoted to maintenance and repairs. Hard-facing of many pieces of equipment is speeded up by the use of the semi-automatic welder applying Stoody 100. On ripper and bucket teeth which are subject to severest wear, Stoody Tube Borium is applied manually as a final overlay.

Hard-facing methods used here are described in the Stoody Guidebook and the folder on semi-automatic wires. See your Stoody dealer for a copy of this literature (check the yellow pages of your phone book) or write direct.

RIPPER TEETH—are hard-faced with two close, parallel beads of Stoody 100 across the point with an open-bead cross pattern up the tooth face. Points also receive a bead of Tube Borium on the under sides.

SHOVELS AND TEETH—at noon and at the end of the second shift tooth points are touched up with Tube Borium. Three stringer beads on the tooth are equivalent to a full inch of bare tooth wear. With this treatment teeth usually last six to eight shifts. Repointer bars are welded on worn teeth, hard-faced semi-automatically with Stoody 100 and finished off with Tube Borium.



SIDE BLADES ON LOADERS—are subject to severe wear from "scooping" action. Stoody 100 holds it in check.

STOODY COMPANY
11976 East Slauson Avenue
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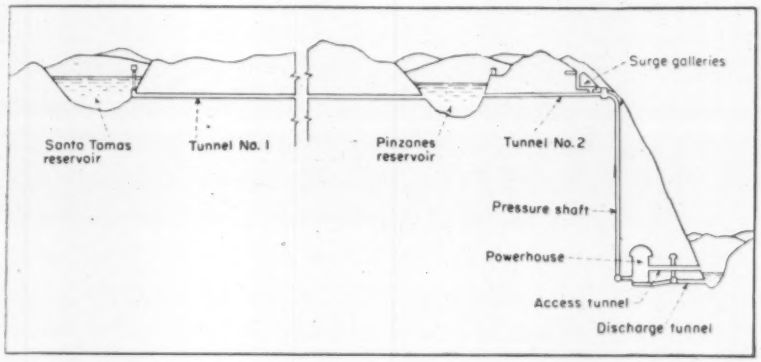


Two dams in tandem store and regulate water at . . .

Tingambato—Last Station in Mexico's 6,335-ft-Head System

With the first of three turbine-generators being readied, Tingambato—most spectacular unit of Mexico's Miguel Aleman Hydroelectric System—will soon be on the line. And when the other two units are cut in, Tingambato will add a total of 150,000 kw to the 216,-775-kw capacity of the system.

The Tingambato project presented the greatest construction and engineering demands of any of the parts of the Aleman system. With a mountainous drainage area of 1,300 sq mi, the hydroelectric network encompasses a series of dams, tunnels and canals to channel waters beginning at 8,600 ft above sea level through the penstocks of five power plants, the lowest of which is Tingambato, located at elevation 2,265 ft.

Located 120 miles west and slightly south of Mexico City, Tingambato includes two dams and an underground powerhouse connected by nine miles of tunnel and a 1,127-ft pressure shaft. Tunnels, shaft and powerhouse were blasted out of rock.

Water from Santo Tomas, dam No. 1, flows through tunnel No. 1 to discharge into Pinzanes, dam No. 2. From there it goes through tunnel No. 2 to a pressure shaft at the powerhouse site, and down to the generating units in the underground powerhouse.

• **From dam No. 1**—Santo Tomas, the first step in the Tingambato squence, serves as regulator and principal supply source. It controls the course of Ixtapan del Oro River, which unites with the Tilostoc River at the dam basin.

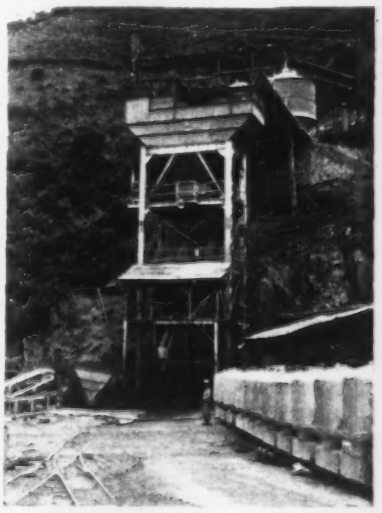
Santo Tomas Dam is a rockfill, impermeable-center type. It is 171 ft high, 20 ft wide at its crest, 502 ft long, and has a total volume of 408,000 cu yd. Its upstream slope is 1.75:1 and the downstream slope, 1.41:1. Tunnel No. 1 begins 61 ft below the crest.

This first tunnel, which discharges into the reservoir behind dam No. 2, is 6.3 mi. long with an inside diameter of 11.8 ft. The first 9,000 ft. were blasted through alternating strata of columnar basalt, brecciated basalt and metamorphic shale. The remainder was extremely hard granite. Excavation took 19 months. The tunnel is lined with concrete of minimum 6-in. thickness.

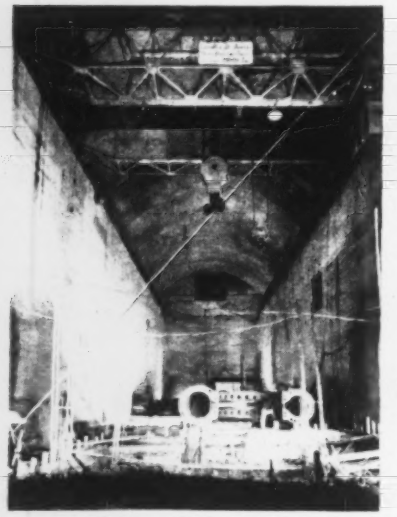
• **To dam No. 2**—Tunnel No. 1 discharges into Pinzanes, a regulator dam consisting of a water-sluiced rockfill with a covering of hand-fitted rock on the upstream surface. Over this are placed reinforced concrete slabs made watertight at the joints with copper waterstops. Pinzanes is 220 ft high, 16.5 ft wide at its crest and 846 ft long. Upstream slope is 1.2:1, downstream 1.3:1. Total volume is 392,000 cu yd. Two cubic yards of jetted water per cubic yard of dumped rock were used for placement and compaction.

The second tunnel in the sequence emerges 69 ft below the crest of Pinzanes. Overall length is 2.7 mi. with an inside diameter of 12 ft. Blasting

PINZANES, dam No. 2 in the Tingambato project, is a rockfill structure, with reinforced-concrete-slab facing made watertight with copper inserts at the joints.



CONCRETE PLANT loads containers. Concrete is then blown into the lining forms.



POWERHOUSE at Tingambato was blasted out of rock, suffered two rockfalls.

was through the same extremely hard granite encountered at the end of the first tunnel. Excavation took 14½ months. It also is concrete-lined.

A series of wells and oscillating galleries, which form the surge tank system, is located 100 ft back from the outlet of the tunnel. And a valve house is set a few feet back from the outlet.

• **And the powerhouse**—Tunnel No. 2 ends at the 1,127-ft pressure shaft leading to the underground powerhouse. The first 60 ft of the 13.86-ft dia. shaft was excavated from the top down; the remaining 1,067 ft, from the bottom up. For the bottom work, a 1,700-ft adit—which now serves as access tunnel to the powerhouse—was blasted through the mountain. By raising a falsework shielded by a bulkhead, the workers each day gained access to the overhead rockface. The vertical shaft is lined with welded steel plate, 11.4 ft in diameter. Work took 7¼ months.

Blasted out of granite, the underground powerhouse is 207 ft long, 114 ft high and 39 ft wide. Work here was set back when blasting in fractured granite caused two rockfalls, four months apart. First, one long wall crumbled, and it was buttressed and shored with reinforced concrete, and further strengthened by inserting 15-ft lengths of extra-strong steel pipe. When the opposite long wall crumbled, the remedy was repeated. As a result, excavation of the powerhouse took 19 months.

Three Francis-type turbines set on vertical shafts operate under a pressure of 562 psi. Operation efficiency of the unit is expected to run to 90%.

With all major construction now behind it, Compania Constructora El Aguila—of Mexico City—which was awarded the $11.2-million construction contract—says that the two toughest parts of the job were living 31 mi of road through the mountainous virgin territory and completing the powerhouse.

Oswaldo Gracia Medrano is resident engineer for El Aguila.

All power produced by the system is sold to Mexican Light & Power Co., which is owned largely by foreign private capital.

Peru Port Plan

$10 million to be spent on the Pacific port of Callao

Reorganization and new construction of Peru's principal port of Callao is to start shortly at a total cost of $10 million.

The work will be under supervision of a port authority under direction of Col. Howard W. Quinn, a U. S. citizen. A loan of $6.6 million is expected from the World Bank to cover foreign exchange costs while the remaining $3.5 million will be financed by the authority itself.

The new construction, scheduled for completion within four years, will include four warehouses; bulk petroleum-handling facilities; a new three-berth pier equipped with a loading tower and belt conveyor system for handling zinc concentrate ores. Existing structures on two piers are to be modified to accommodate four passenger ships. Among other improvements will be dredging 4,000,000 cu yd of material from the channel, both inside and outside the breakwater; repair of the breakwater, and construction of a small yacht basin. Included in the program will be the purchase of four diesel locomotives, two 750-hp diesel tug boats and a 1,000 cu yd sea-going hopper dredge.

The port authority plans to advertise for bids on an international basis with the contract awarded to the lowest qualified bidder.

The new port program was approved in May 1955. And the firm of Parsons, Brinckerhoff, Hall & Macdonald of New York was selected in December, 1955, to carry out the work at a cost of $375,000. Three engineers, headed by Theodore O. Blaschke, made the studies in Peru. Preliminary engineering studies have been completed and a report made to the World Bank. Final detailed engineering surveys and reports are now well under way.

In mid-1956 the port authority concluded the first stage in its modernization plan. The work, done over a period of four years at a cost of more than $2.5 million, included the installation of grain elevators and a conveyor system, modernization of existing facilities, purchase of modern cargo-handling equipment and the inauguration of efficient operating methods.

India Hails the Opening Of Long Tube-Link to Kashmir

What will be, when completed two years hence, one of the world's longest road tunnels, was partially thrown open to traffic this week when the Indian Vice-President drove through the western tube of the German-constructed Banihal tunnel, which now links India and the Kashmir Valley via an all-weather road.

Six hundred foreign and Indian technicians under the supervision of the German tunnel builders Barisal and Kunz, have been working three shifts a day on this $6 million project.

When completed, Banihal will be 1.6 miles long and will consist of two tubes, each with a 10 ft 6 in. roadway and sidewalks. Four hundred vehicles an hour in either direction is the tube's rated accommodation capacity, but the now-opened western tube will only accommodate 250 vehicles, until the ventilation system is completed.

The work was started in 1955.

It was forty years ago that the pack pony and the human back were first used as transport over the 10,000-ft Banihal Pass, where snow lingers in the shade even on the hottest day. In 1922, the Maharaja of Kashmir's private motor road over the pass was first thrown open to the public, but it is snow-blocked for three and a half winter months, during which time Kashmir is provisioned by air from India.

Canada Plans New Bridge Over the Fraser River

The British Columbia Government has said that it will build a new $4-million arch bridge over the Fraser River at Spuzzum.

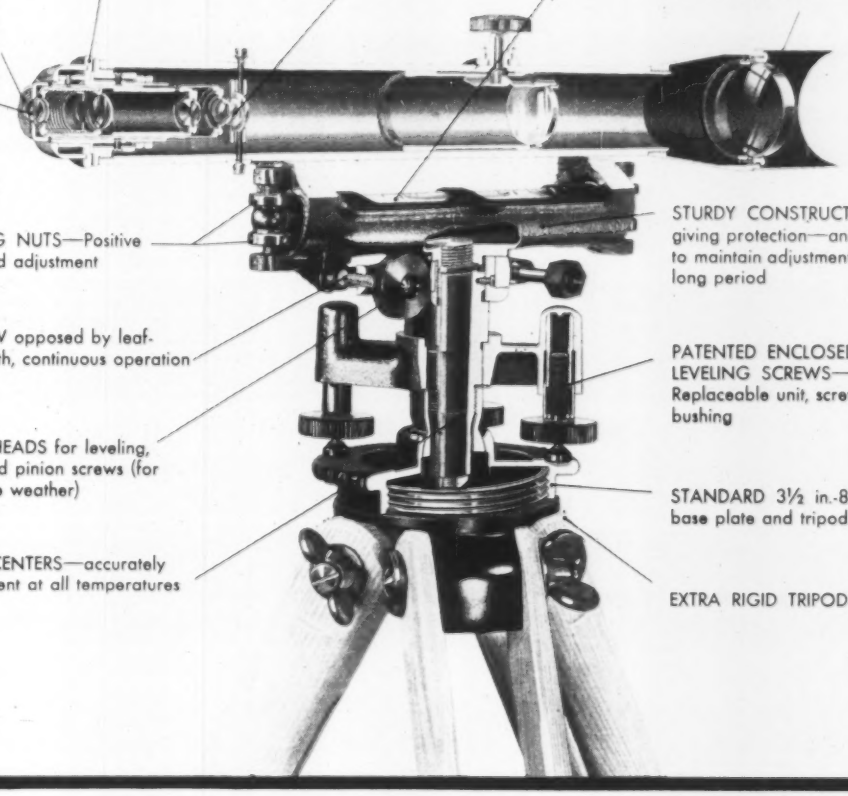
The new structure, which will replace the old Alexandria Bridge at the site, will be one of the longest steel arch bridges in the world, with an arch span of 805 ft. Over-all length will be 1,631 ft, with plate girder approach spans. Rise of the arch will be 115 ft 6 in. Height from the water to deck will be 216 ft.

The structure will carry two lanes of traffic and two sidewalks.

(International continued on page 176)

The Gurley Engineers Level

Wye or Dumpy Types



VARIABLE POWER EYEPIECE
Permits adjustment of magnification when illumination changes

NON-METALLIC EYEPIECE CAP
(for comfort in extreme weather)

HAZE FILTER—
Improved image contrast under nearly all light conditions

LEVEL ADJUSTING NUTS—Positive opposing nuts hold adjustment

TANGENT SCREW opposed by leaf-type spring; smooth, continuous operation

NON-METALLIC HEADS for leveling, tangent, clamp and pinion screws (for comfort in extreme weather)

LONG TAPERED CENTERS—accurately fitted; free movement at all temperatures

COVERED GLASS RETICLE—
Cross lines on glass. Covered for protection and easy cleaning

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giving protection—and rigidity to maintain adjustment over a long period

PATENTED ENCLOSED LEVELING SCREWS—
Replaceable unit, screw and bushing

STANDARD 3½ in.-8 thread base plate and tripod head

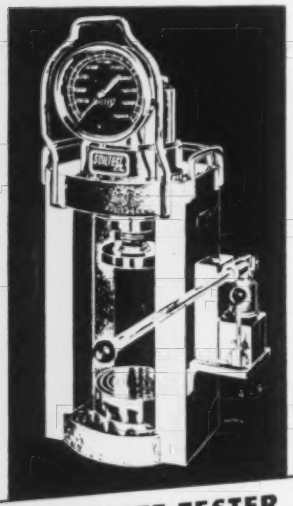
EXTRA RIGID TRIPOD

Model 372 Dumpy Level

W. & L. E. GURLEY, TROY, N. Y.

GURLEY

JOB-SITE TESTING SAVES MONEY



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CAPACITY TO 200,000 POUNDS

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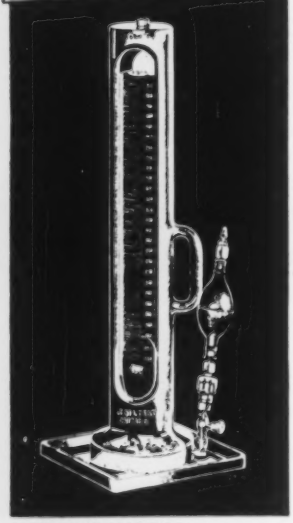

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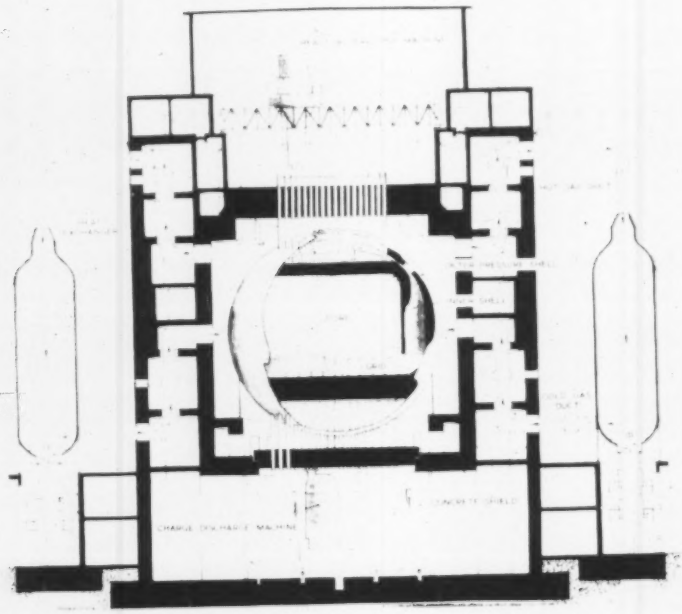

Great Britain awards contracts for . . .

Three More Nuclear Plants

Great Britain plunged full speed ahead with its nuclear electric power program recently as contracts were awarded for the first three commercial stations whose capacities total almost 1 million kw.

Although based on the Calder Hall prototype (ENR Oct. 25, 1956, p. 48), designs of all three plants make the latter look somewhat ancient. The prototype has 92,000-kw capacity, produced from a natural-uranium, graphite-moderated, carbon dioxide-cooled reactor housed in a welded steel pressure vessel 40 ft in dia, 60 ft high and operating at 100 psi. Reactor coolant gives up its heat in exchangers to produce steam at a maximum of 200 psi and 590 F.

• **70-ft sphere**—Largest of the commercial stations, a 360,000 kw installation somewhere in Scotland, is to employ two giant spherical reactors 70-ft in dia that will operate at 150 psi. Steam is to be taken off from 16 heat exchangers (8 per reactor) at 700 F to drive six 60,000-kw turbo-generators. Overall plant thermal efficiency is put at 28.8% (versus 27% for recent coal-fired stations).

The construction spotlight will probably center on the reactor vessel, as at Calder Hall. It will be a double shell structure whose outer shell alone will weigh 1,000 tons. This is to be of 3-in. boiler plate designed primarily to resist the operating coolant pressure. A thinner inner shell of cylindrical shape will be fabricated of temperature-resistant steel and is to provide heat protection to the outer member (pressure differential is expected to be only 4 psi). This double shell arrangement will eliminate many of the site welding problems experienced at Calder Hall where a maximum 2-in. thickness in one plate of special low-carbon (and low-strength) manganese steel had to be employed.

To handle pressure vessel and other heavy loads, a huge 300-ton gantry crane, spanning 200 ft, is to be built. This could possibly be the world's largest. Eight feet of concrete, about 150 ft high, will surround the reactor and serve as the biological shield.

• **Only slightly smaller**—Second of the nuclear plants is to be at Bradwell in Essex, England. It will have 312,000 kw installed capacity from six 52,000-kw generators. Each of two reactors is to be encased in a 67-ft-dia sphere housing CO_2 coolant at 150 psi. Although not confirmed by the designers, it is believed that only a single shell of 3-in. plate is

(Continued on page 179)

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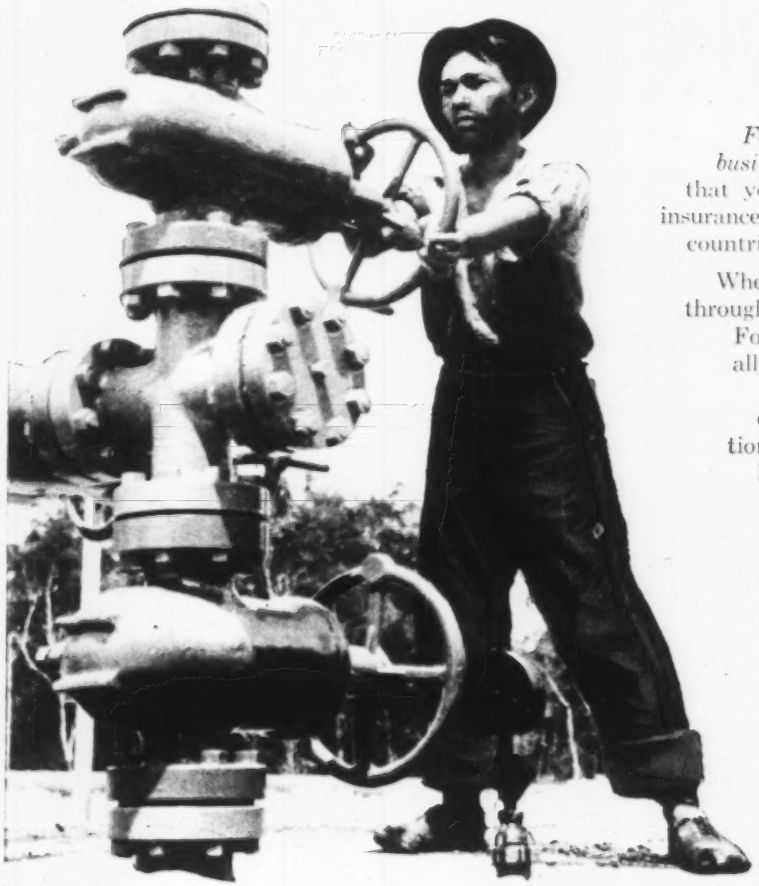

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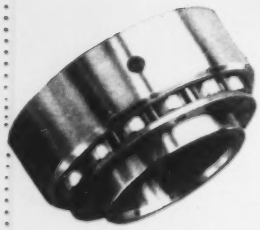

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to be used to form the pressure vessel. Steam is to be drawn from 12 heat exchangers (6 per reactor) at 755 psi and 704 F.

The third station, of 320,000-kw capacity, will be built at Berkeley in Gloucestershire, England. Its design utilizes two cylindrical pressure vessels 50 ft in dia and 80 ft high, which are to operate at 125 psi. Three-inch plate again will be used.

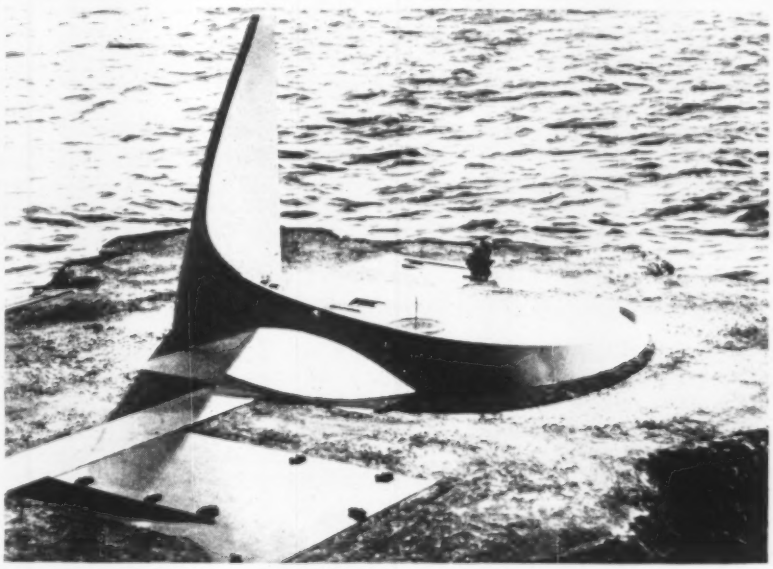
The Berkeley steam cycle is somewhat different from the other two stations in that superheated steam at 306 psi and 612 F will be produced. Output from the heat exchangers will drive four 80,000-kw turbo-generators.

• **Costs are hazy**—The cost picture is somewhat clouded at present. A reported capital cost of $300 per kw (exclusive of uranium fuel which runs about $100 per kw) at the Scot plant is doubted by some. The other awardees have placed costs within a rather wide range—from $300 to $390 per kw.

Unit generating costs are likewise vague, although it has been indicated that kwh costs would rise due to a decrease in the value of plutonium, produced as a byproduct at all stations. Previous government estimates placed the cost of nuclear power between 5 and 7 mills per kwh.

Extent of the current British nuclear power program, increased due to the Suez crisis, is also not yet clear. Early reports had the original 10-year, 12-plant, 2-million-kw program increased to 15 larger plants capable of 4 million kw. Generalized capital cost figures indicate a 10-year program nearer 5 million kw.

All the works will be owned and operated by Britain's Central Electric Authority and the South of Scotland Electricity Board. The Scotland (SSEB) design and construction has been awarded to a General Electric Co.–Simon Carves consortium; Nuclear Power Plant Co. gets Bradwell (CEA); AEI-John Thompson Group is to build at Berkeley (CEA).



Wall 350 Ft High Honors Explorer

The Portuguese government is erecting a spectacular concrete wall that will be 350 ft high as a monument to Prince Henry, a 15-century Portuguese navigator.

Located at Cape Sagres, on the southwest coast, the wall will be the outstanding feature of a $1.2-million project including an underground museum and crypt. It will be completed by 1960, the 500th anniversary of the explorer's death.

In plan, the wall describes a 320-ft-diameter semicircle. The top surface slopes upward throughout its length, attaining maximum height at one end. Near midlength, a 300-ft arch opens through the wall. The wall will require 21,000 cu yd of concrete.

The design, selected from 50 entries in a 1954 competition, was executed by a team including J. Andresen, architect, and Ferry Borges and Simoes Coelho, engineers. Model tests provided the basis for the structural design.

(International continued on page 180)

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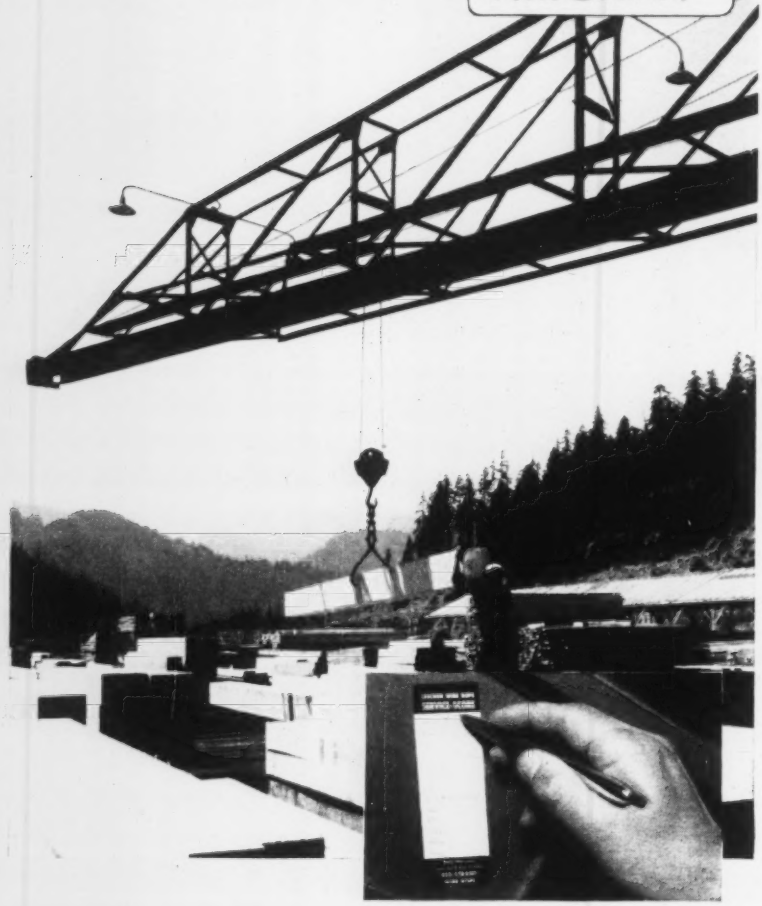

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Service-Score Stickers are available from any Leschen field man or distributor. Just ask, or write Leschen Wire Rope Division, H. K. Porter Company, Inc., St. Louis 12, Mo.

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H. K. PORTER COMPANY, INC.

. . . International

The Suez Crisis Revives Talk of Sea-Level Canal

The crisis that has resulted from the stoppage of the Suez Canal has revived talk throughout Central America of the long-discussed proposal for a sea-level canal across the Central American Isthmus.

According to reports to the McGraw-Hill World News Service, many Panamanian and U. S. officials have had occasion to look again at plans to convert the existing Panama Canal into a sea-level waterway—a project that has been estimated to cost up to $4½ billion. It is generally agreed that reconstruction of existing locks—already becoming tight fits for modern naval vessels—would not solve the problem of defense, since the locks offer vulnerable targets for air attack.

A second point for discussion is the general question of sovereignty. The Pan American government has taken several occasions to mention its claims of sovereignty over the Panama Canal zone, although the 1903 treaty under which the U. S. operates the zone appears to give the area to the U. S. in perpetuity.

These questions, however, again have raised the possibility of a big canal to be built in Nicaragua. It is recalled that the late President Somoza of Nicaragua had offered to cede to the U. S. a route following the San Juan River, close to the Costa Rican border, or from the Caribbean to Lake Nicaragua and thence for a 17-mile ditch to the Pacific Ocean.

Such a cession of land might eliminate questions of sovereignty, local observers point out.

Peru Plans $9-Million Secondary Road Program

In an attempt to remove the consequences of a serious drought, the Peruvian Department of Public Works has announced plans for an $8.9-million program to construct four secondary highways in southern Peru.

The roads will provide access from marginal farms in overcrowded highland areas to the rich tropical and subtropical valleys on the eastern slope of the Andes. Reason for construction is to facilitate emigration of thousands of Sierra Indians and, at the same time, provide work for an estimated 15,000 to 20,000 agricultural workers who have been injured seriously from a drought in southern and central Andean highlands since the end of 1955.

The project will have priority over any other road construction taking place in the republic.

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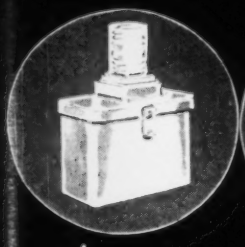

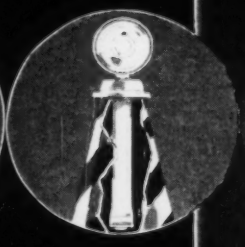

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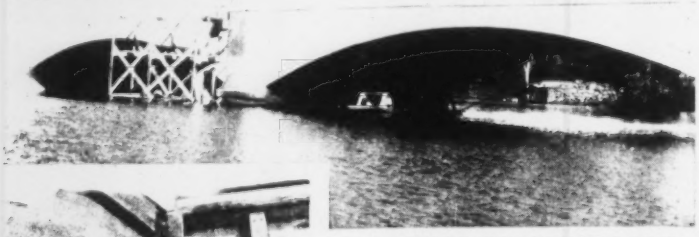

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Legal

Absence of Building Permit Created Breach of Contract

When a contract imposes upon a contractor the burden of complying with local building laws and regulations, failure to obtain a building permit before commencing work is a breach of contract entitling the owner to damages.

In a New York case, a contractor had agreed to erect the exterior shell of a house and garage. The owner agreed to pay the contractor $6,450 in installments as the work progressed, the first $1,00 to be paid on the signing of the contract and $1,000 to be paid when the foundations were completed.

The specifications, incorporated in the contract by reference, provided: "Contractor must comply with all local building laws and regulations, procure all necessary permits, give all notices required by law, obtain official license for temporary obstructions, enclosures, water pipes, etc., necessary to perform work specified herein. Owners' plumber will submit card and license No. for Plumbing and Building Permit."

The contract contained the following provision: "The owner agrees that if it is necessary to furnish extra labor and material beyond that stipulated in this agreement and such additional materials and labor are required because of the condition of the ground or to obtain a building permit, the owner authorizes the contractor to furnish such additional labor and material that may be necessary and the owner agrees to pay the reasonable price thereof, in addition to the price set forth herein. Said price of necessary work and material will be agreed to in a written form with a specific amount of money and payment date."

At the time the contract was signed, the owner delivered to the contractor a copy of the plans for the work to be performed. A month later, the contractor learned that the local building code prohibited the building of a house on land the elevation of which was not above a specified level, as a result of which it would be necessary to obtain an authorization of a variance of the building code. Thereafter the necessary variance was obtained and the owner instructed the contractor to apply to the Building Department for a permit to erect the structure, which he agreed to do.

The contractor proceeded to build the foundations and, upon completion asked the owner to pay him the $1,000 called for by the contract, which he did. Several days later, the contractor

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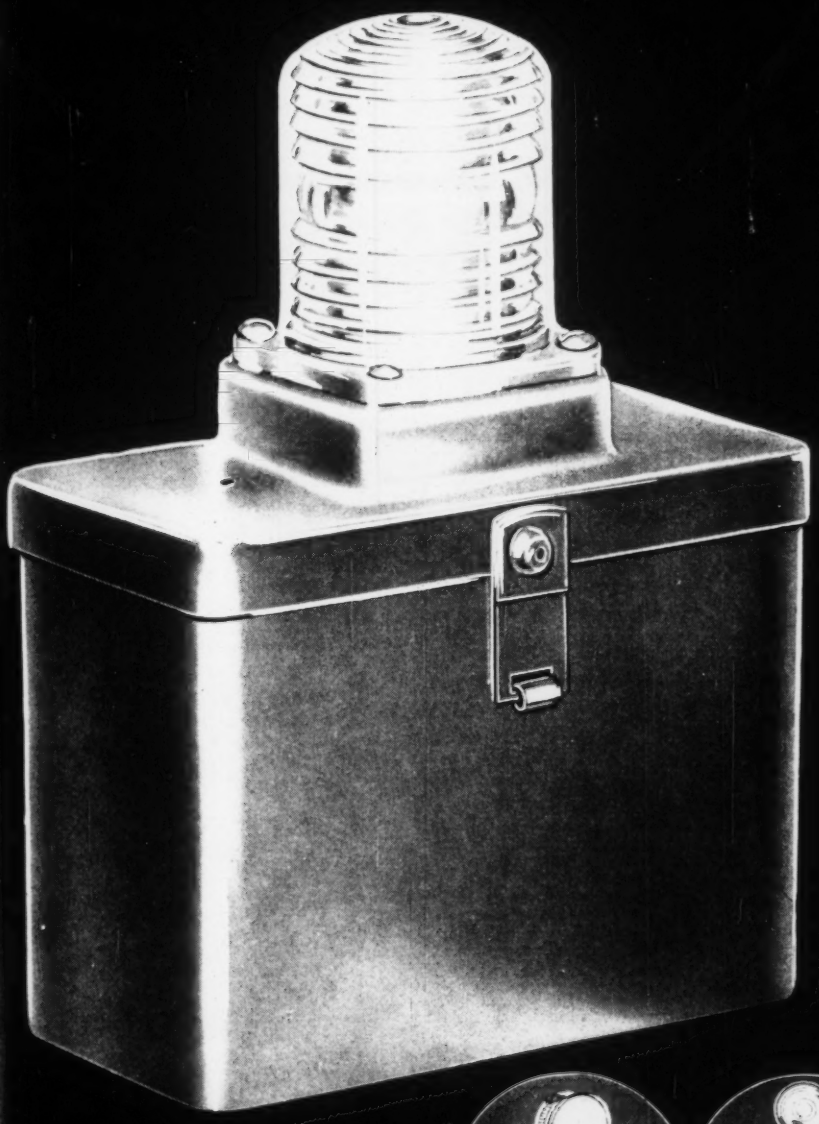

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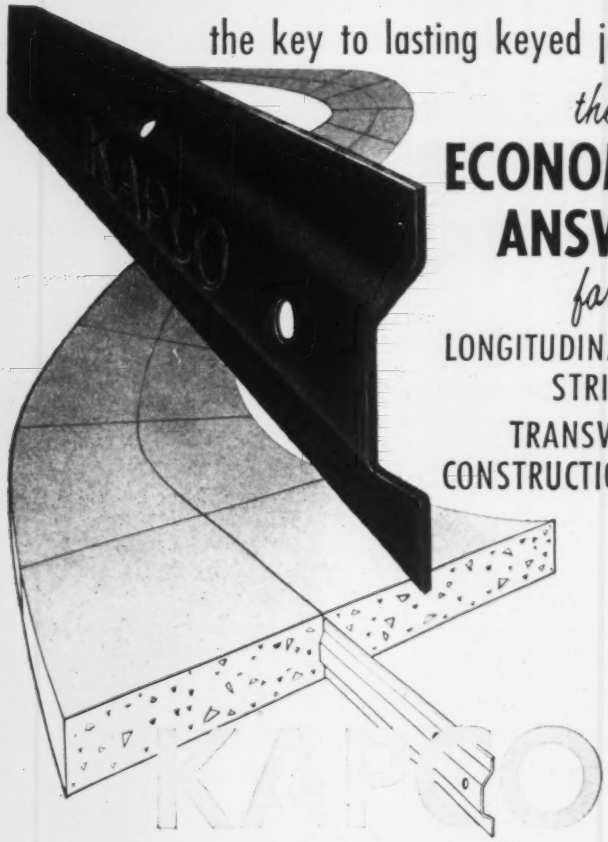

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informed the owner that he had never obtained a building permit, for the work. The foundations were built of concrete blocks. The building department condemned the work and insisted upon the removal of the walls.

At the time the $1,000 payment was made by the owner, he had no knowledge that the builder had proceeded with the work without obtaining a building permit. The contractor had offered to put piles under the concrete block walls that he had built but the building department refused to approve such proposal.

The builder failed to remove the walls and the owner brought an action against him for breach of contract, claiming as damages, the $1,000 paid the contractor, plus the cost of demolishing the foundations. The owner obtained a recovery which was affirmed on appeal[1], the appellate court holding that the contractor's proceeding with the work without obtaining a building permit constituted a breach of contract.

(1) Barrett v. Johnson, 150 N.Y.S. 2d 852, N. Y. Supreme Court, Appellate Term, March 8, 1956.

Finders' Fees Outlawed In Government Contracts

There are government statutes that make it unlawful to obtain government contracts on a commission basis, and no recovery can be had for obtaining contracts on such a basis. In fact, the law provides that every government contract shall contain a provision to the effect that the contractor has not employed any person to solicit or to secure the contract on a commission basis or contingent fee.

The statutes, however, provide for an exception in the case of contracts obtained through bona fide established commercial or selling agencies maintained by the contractor for the purpose of securing business.

The New York Courts as a general rule have not declared such contracts illegal, unless it is shown that illegal or corrupt practices have been employed to obtain the contract. However, where a government contract was involved, the court followed the United States statute.[1]

The court, in its opinion, stated, "If, as must be conceded, the national government has power to protect itself against contracts of the kind here in question, the protection afforded must be uniform in all its ramifications, including a uniform rule governing the enforceability of contingent fee contracts between principal and agent." The above quotation was taken from the case of Mitchell v. Flintkote Co., 185

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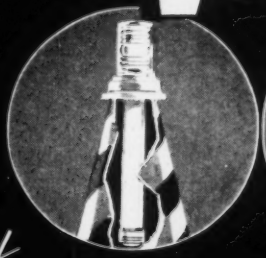

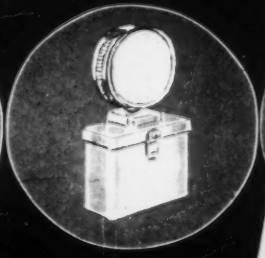

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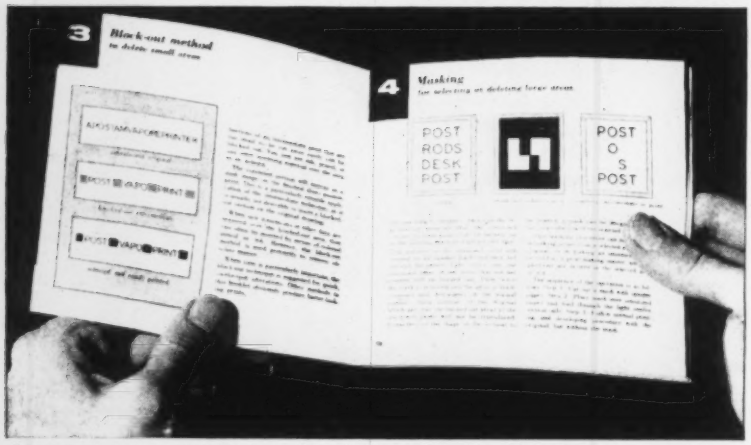
DRAFTING TRENDS



Typical pages from "11 Ways to Save Drafting Time," a booklet on the use of intermediates. Each technique is fully described and illustrated with specific examples.

Helpful booklet on drafting tips offered again

An interesting booklet called "11 Ways to Save Drafting Time" is available without charge to engineers and draftsmen. Published by Frederick Post Company, it compiles the many ways of using *intermediates* to modify drawings without changing the original.

As most draftsmen know, an intermediate is any translucent reproduction master printed from an original drawing. Once the drawing is printed on the intermediate, this "duplicate master" serves as the source for future print making. By modifying only the intermediate and leaving the original unchanged, draftsmen save valuable hours of tracing and redrawing.

The booklet shows 11 specific ways of using intermediates to make changes, each one illustrated with examples. Some of the techniques covered are scissor editing, masking, the block-out method, successive additions and preprinting.

The other methods shown are transparent matte tape, pick-off transfer, composite grouping, composite overlays, non-reproducible blue and use of corrector fluids.

Intermediates can be used in a variety of ways to cut costly retracing, changing and modifying of drawings.

The techniques described apply to various print-making methods such as moist-developed process, ammonia process, blueprint, sepia negative and even reproduction cloths in some instances.

Further information on the new "11 Ways" booklet is available from the Reader Service Division of the Frederick Post Company, 3658 N. Avondale Avenue, Chicago 18.

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. . . Legal

F. 2d1008, 1011. The court referred to several New York cases that followed the Federal Court decisions.

The court, in its opinion, further stated: "The logic of the Federal interpretation of the Executive Order, although it be a stricter one than that employed by the New York cases cited, becomes all the more persuasive, when we consider the notorious evils involved in this type of contract. Surely, we cannot be oblivious to the Federal Government's right to obviate these evil practices. On the contrary, we should lend our support."

(1) Federal Pacific Electric Co. v. McAdams, 139 N.Y.S. 2d 418.

Sub's Materialman Recovers From the Prime Contractor

A Maryland court has held that a prime contractor, under the following circumstances, is liable for the materials that were used by one of its subcontractors.

A construction contract provided that the prime contractor would be obligated to pay for all materials and labor necessary for the execution of the contract and for the completion of the work. Part of the job was sublet to another contractor who had failed to pay for certain materials used by him in the performance of the contract and the materialman then brought an action against the prime contractor and its surety to recover for the value of the materials so furnished. The materialman obtained a judgment in the trial court which judgment was affirmed on appeal.[1]

(1) Kirby v. Board of Education of Cecil County, 123 A. 2d 606, Court of Appeals of Maryland, June 18, 1956.

The Right to Rescind Bids Because of Clerical Errors

The courts have developed various rules under which contractors are allowed to withdraw bids containing clerical errors. A summary of the Maryland law appears in the following case.

A contractor submitted a bid for a city job, which as a result of a clerical error was over $500,000 under the amount of what the bid would have been had not the clerical error been made. The contractor discovered the error in the bid after the bids were opened and before his bid had been accepted and immediately notified the city of the mistake and asked to be permitted to correct the same and upon the refusal of the city to permit him to do so, brought an action to rescind the bid and for a return of the money deposited with the bid. The court held[1] that the contractor was entitled to such

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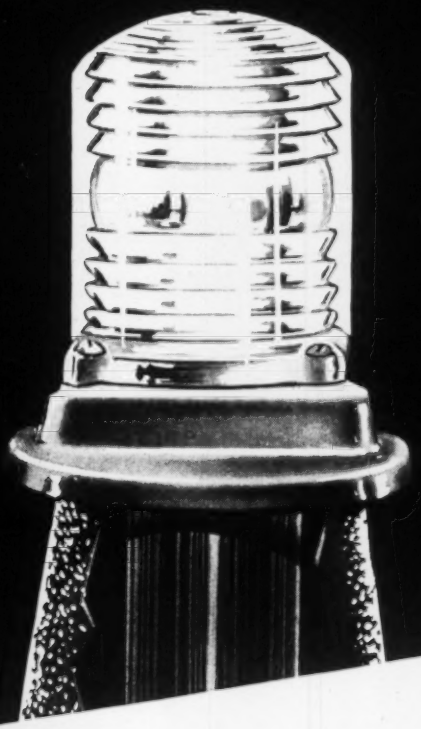
NEW TRANSISTORIZED FLASHERS WITHSTAND TOUGHEST ABUSE..



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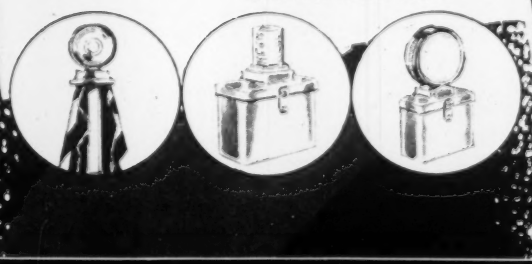
Waterproof and shockproof. Nothing to get out of order. Transistor circuit is unaffected by impact, weather or daily construction abuse. Uses simple radio panel bulb and standard batteries—available anywhere. Can be turned on or off without opening case. Takes only 20 seconds to change batteries. Write for free Catalog-Folder and prices.

Now bring your hazard lighting up to date. New Visi-Flash is safer, brighter, longer-lasting. Use coupon to get full information.

Depending on the location or size of the hazard, and how long the lights must remain on, various types of warning lights may be best suited. Only Dietz offers you a complete line of all principal types: lanterns, torches and flashers. Our colorful new 24-page catalog has the facts. Send coupon for your free copy.

Available in 4 models: Barricade and Traffic Cone styles in either double-face or 360° lens



Free WARNING LIGHT CATALOG

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Syracuse, N. Y.

☐ Send me catalog and price list
☐ Arrange for on-the-spot demonstration

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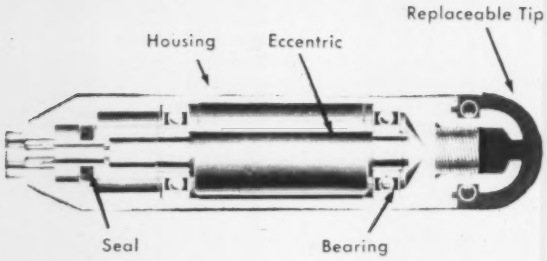


SIMPLE DESIGN — Short head Viber vibrators are simple in design and have few parts as indicated in cut-away picture above. Head assembly with replaceable rubber tip is shown at left. Assembly with 3-finned steel cast tip at right.

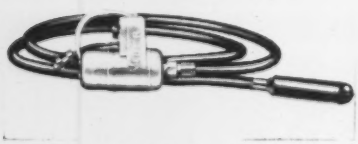
Short Head Viber Vibrators Offer Major Advantages in Placement of Concrete

VIBER VIBRATOR heads are short, easy to manipulate — simple, easy to maintain. Simple construction of the Viber head makes a compact assembly which maneuvers easily around steel and into awkward, hard-to-reach places.

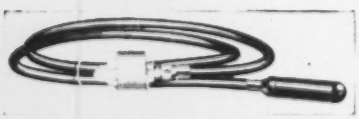
The Viber design utilizes a single eccentric-weight in a heat-treated alloy steel housing. Other parts are one bearing at each end of the weight and a grease seal. Viber patented replaceable rubber tip is standard equipment, with 3-finned steel cast tip optional.

Viber heads are light weight, ranging from 6 to 16 pounds . . . 11 to 12 inches in length and are available in four diameters — $1^{3}/_{4}$ in., $2^{1}/_{8}$ in., $2^{1}/_{2}$ in. and 3 in.

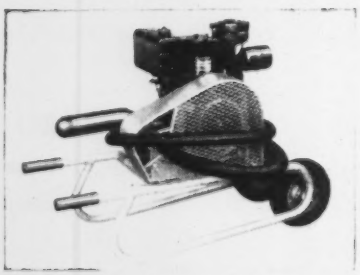
Flexible shaft driven, Viber vibrators are powered by electricity, gasoline or air . . . easily adapted to varying job conditions. They are high speed, operating at speeds between 8500 and 11,000 rpm.



Model E Electric



Model P Pneumatic



Model G Gasoline

Viber Replaceable Rubber Tips

Viber rubber tips save contractors thousands of dollars yearly by preventing damage to forms of plywood and other expensive materials. In addition, since most wear on a vibrator occurs on the end of the housing, use of replaceable rubber tips greatly extends housing life.

Viber vibrators are effective. More work can be done in less time and with minimum danger of damage to forms by using the high speed low amplitude type of vibrator pioneered by VIBER.

For complete information on Viber vibrators and address of nearest distributor, write Viber Company, 726 South Flower St., Burbank, Calif. Dept. 16E1.

VIBER

VIBRATORS SINCE 1931

. . . Legal

relief, notwithstanding a provision in the city charter that once a bid is submitted it is irrevocable.

The court, after reviewing many cases on this subject, stated: "The general rule as to the conditions precedent to rescission for unilateral mistakes may be summarized thus:

(1) the mistake must be of such grave consequences that to enforce the contract as made or offered would be unconscionable;

(2) the mistake must relate to a material feature of the contract;

(3) the mistake must not have come about because of the violation of a positive legal duty or from culpable negligence;

(4) the other party must be put in status quo to the extent that he suffers no serious prejudice except the loss of a bargain. See the cases so holding in 59 American Law Reports, p. 809."

(1) City of Baltimore et al. v. De Luca-Doyle Construction Co., 124 A. 2d 552, Court of Appeals of Maryland, July 12, 1956.

Payment by Contractor Held Release of Surety

Drawing an analogy to the established rule that where a creditor has within his control funds of the principal debtor which may properly be applied toward payment of the obligation, but fails to do so, the surety is discharged, the Supreme Court of South Carolina has freed the surety on a performance bond[1] from liability to a materialman.

A subcontractor and his materialman approached the prime contractor and solicited a payment on the subcontract so that the subcontractor might make payments on his labor and material accounts. A few days later the contractor sent the subcontractor a check payable to the subcontractor and the materialman. The subcontractor obtained the materialman's permission to endorse the name of the materialman on the check and collected on it. When the subcontractor subsequently defaulted on his account, the materialman sought to recover on the performance bond.

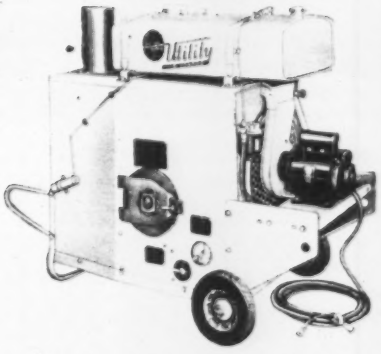
The court held[1] that while the check represented more than the amount owed to the materialman at the time that the check was drawn and although the contractor did not request the materialman to collect his bill from the check, the only reasonable inference was that the materialman had been made a co-payee to enable it to collect whatever amount was owing it from the subcontractor. His failure to do so released the surety.

(1) City Lumber Co. v. National Surety Co., 92 S.E. 2d 128.

Herman Nelson... leads them all in versatility and value!

Better than ever!

Converts from gasoline engine to electric motor in 20 minutes!

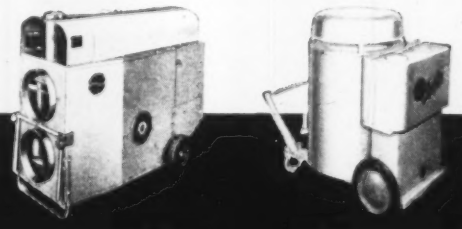


Herman Nelson "UTILITY" Portable Air Heater

Already tops in versatility and value, the "Utility" now offers you new, improved features! "Balanced air" combustion eliminates all smoke and soot. One-piece, 2-compartment fuel tank provides safe, easy filling. The "Utility" offers you *more* because you can *interchange* the power plants to suit your job . . . motor drive where you have electric current, or gasoline engine for remote job sites.

The "Utility" gives the most heat for the least fuel of any heater. It operates overnight without re-fueling. Also operates with either gasoline or fuel oils, without need of adjustments. May be used with or without ducts, and with or without venting, depending on job or location. Engineered for utmost safety, with automatic overheat cut-off, and safety trip valve that shuts fuel off when the prime mover stops. Manual heat control, self-cleaning burner. 75,000 to 425,000 BTU capacity.

ASK ABOUT THE COMPLETE LINE!



"DE LUXE" MODEL

Oil Fired, Electric motor powered. 280- 450,000 BTU capacity. Completely automatic operation.

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Oil Fired, Electric motor powered. 50- 170,000 BTU capacity. Low price!

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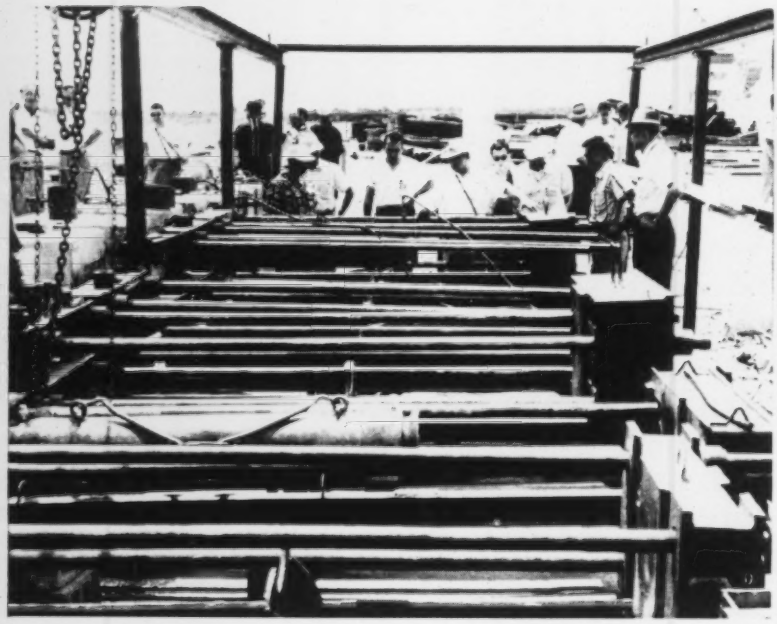
This Amazing Prestressed Concrete Industry



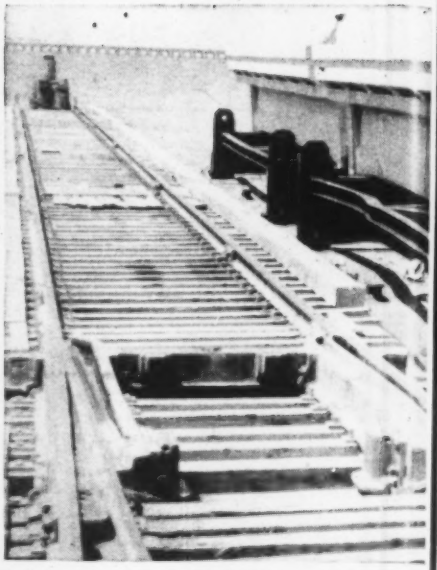
What Is Behind Its Phenomenal Growth?

This is a question which has been asked many times. Union Wire Rope Corporation has answered with the sound reasons for venturing a huge capital investment in expanded facilities and in research to master the technical know-how of producing prestressed, stress relieved, high tensile wire and strand. Without this key element prestressed concrete would still not be possible and practical.

To check our own reasons and to develop all of the fundamental facts responsible for the spreading use and acceptance of prestressed concrete,

We Asked A PANEL OF PIONEERS In the Prefabrication of Prestressed Concrete Members To Summarize the Facts Which Has Enabled Them To Maintain a Yearly Growth of 200 to 300 Percent.

What follows is straight from the horse's mouth. It is a summary of the fundamental facts contributed by a sizeable group of prestressed fabricators and consultants. All are pioneers who have had a part in the development of prestressed concrete and experienced its growth from a trickle five years ago to become the building material to be reckoned with by every factor in the building industry.



Here Is a List of Prestressed Products Which A PANEL OF PIONEERS Are Prefabricating

Girders

Roof Slabs
Regular, Lightweight, Lift, Channel, Thin shell, Hollow centers, Composite.

Beams
Joists
Trusses
Columns

Piles and Caps
Foundation, Marine, Fender

Lintels
Wall Panels
Siding
Posts

Pavements
Highway, Airport

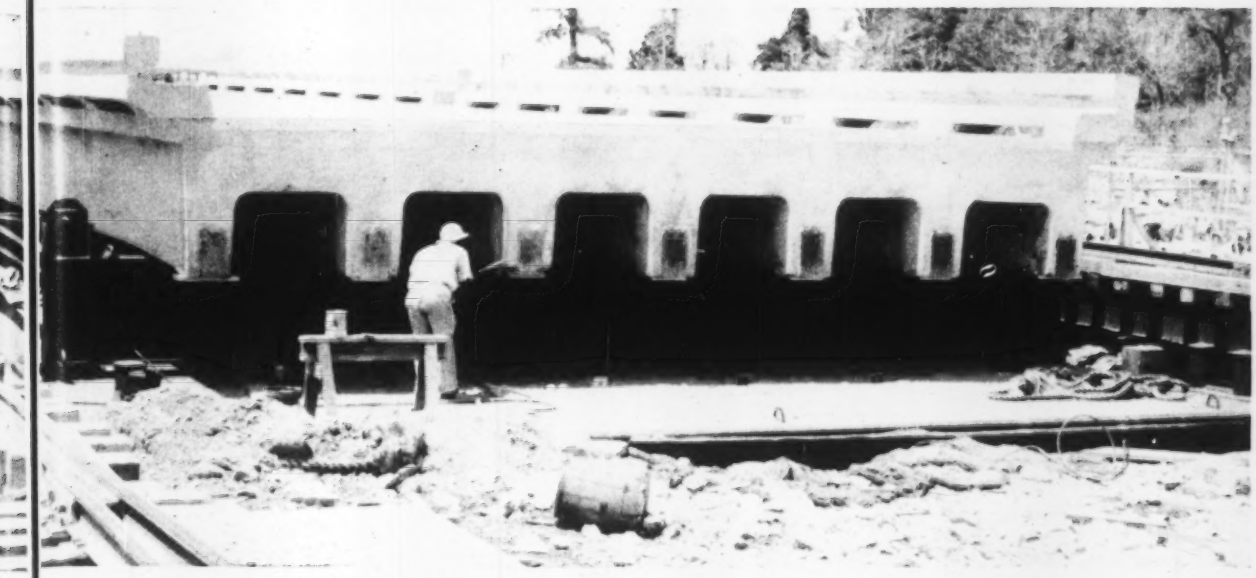
Stadium
Framing, Seats

"Future Applications of Prestressed Concrete Beyond Prediction"

These are the words of one and the consensus of opinion of others on our panel of pioneers. Other prestressed concrete products mentioned as either being prefabricated or tested and proposed are:

- Missile Wings
- Barges
- Transmission Line Supports
- Piers
- Seawalls
- Wharfs
- Arches
- Skews
- Spring Board—For Swimming Pools
- Off-shore Drilling Piles Platforms

While some of these may seem novel, many will become commonplace. Prestressing concrete for barges, for example, could very well become an industry in itself as is the prefabricating of bridge members.



PANEL OF PIONEER Prefabricators Cite These Outstanding Prestressed Concrete Advantages...

1. Fully Utilizes Two Inherent Strength Factors

Prestressing combines and enhances the inherent characteristics of two of the foremost construction materials—

A. The compression strength of concrete with

B. The high tensile strength of stress relieved cold drawn steel wire and strand.

2. Basic Economy

A. Steel for prestressing is six times stronger than ordinary steel but only approximately 3 times more costly.

B. Concrete for prestressing is twice as strong but only 10 to 20% more costly than ordinary concrete.

C. Prestressing consumes less steel and concrete to attain equal or greater structural strength more economically.

3. Structural Balance

A. In prestressed concrete, stresses and strains are balanced to produce structures whose deflections are under definite control.

B. Cracks, otherwise unavoidable in concrete, are eliminated by prestressing.

4. Design Economy

A. Prestressed concrete makes possible thinner sections, lower depth to span ratios, longer cantilevering without ballast beams and reduction in weight. All of these factors enable the designer to effect savings in foundation, in columns, in wall height or to convert head room into usable cubage.

B. Steady progress in standardization of sections under the auspices of the Prestressed Concrete Institute is making prestressed concrete more and more versatile from the standpoint of designers.

5. Prestressing Is Pre-Testing

A. Because they are subjected to greater loads in fabrication than is imposed upon them in the field, precast, prestressed members are in reality pretested.

B. Produced by factory methods, under closely controlled conditions, prestressed concrete guarantees the designer structural performance to meet or better expectations and affords relief from extensive supervision and inspections.

6. Stock Pile Availability

A. Factory line production methods with time saving devices insures delivery of prestressed concrete members from the production line in step with contractors work schedules.

B. Production of prestressed sections proceeds at top speed, affording maximum utilization of labor and stockpiling against projected construction.

C. Prestressed concrete eliminates construction delays by by-passing materials in short supply or on extended backlog delivery.

7. Speeds Up Construction

A. Construction by the older, conventional methods involves both erection and fabrication on the job site.

B. The latter is accomplished much faster in central plants or on the site mechanized plants and the resulting prefabricated units are erected with clock-like precision.

C. Often it is possible to complete structures in half the time required by conventional methods. It is often possible to erect prestressed concrete in the time required to make, place and shore up forms for poured in place concrete.

8. Permanence of Concrete—Plus

A. Well known is the durability of concrete. Well known too is its vulnerability to cracking. Cracks lay it and its reinforcing open to deterioration.

B. Prestressing makes concrete a flexible material with the ability to withstand extraordinary deflection and recover without cracking.

9. Insurance Savings

Comparison of insurance premiums are reported on new buildings with prestressed concrete roofs as against old buildings with wood roofs. Roughly the yearly premium on the latter is more than for 5 years on buildings with prestressed roofs. Though this is a comparison of extremes, it is indicative of how prestressed construction is regarded by insurance companies.

10. Economy of Maintenance

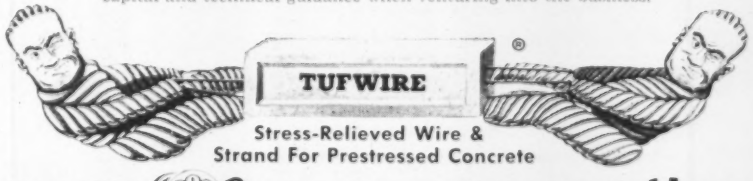
A. Even in marine construction or in construction subjected to other extreme corrosive conditions, the cost of maintenance on prestressed concrete construction ranges from nil to the expense involved in painting in cases where color is desired.

11. Widely Competitive

A. The initial cost of prestressed concrete is such as to enable its prefabricators to successfully bid against the permanent, fire resistant, all-weather types of construction in many types of structures.

B. When the collateral economies effected by prestressed concrete, such as greater and more flexible strength for longer spans and fewer columns, balanced stresses and strains and controlled deflection, thinner sections, lower depth to span ratios, lower wall heights and increased usable cubage, ready availability, speedier erection, negligible maintenance and lower insurance premiums are considered, then the competitive edge is definitely on the side of prestressed concrete for a growing list of structures.

So goes the summary of the thoughts of a panel of pioneers except for a warning which was sounded: Be sure of adequate capital and technical guidance when venturing into the business.

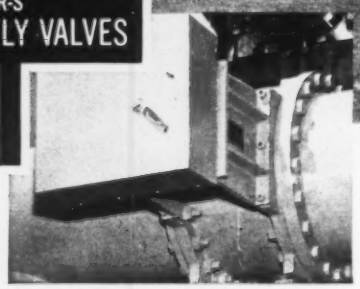


Stress-Relieved Wire & Strand For Prestressed Concrete

union Wire Rope corporation

Specialists in high-carbon wire, wire rope, braided wire fabric, stress-relieved wire and strand.

2228 Manchester Avenue Kansas City 26, Missouri



66 R-S Rubber-Seated Butterfly Valves, in sizes from 14" to 54", are used with hydraulic and manual operation in the new Filtration Plant.

Engineers: Greeley and Hansen, Chicago

NIAGARA FALLS, N. Y. RELIES ON RUGGED R-S RUBBER-SEATED BUTTERFLY VALVES

The new Niagara Falls Pumping Station and 32 MGD Filtration Plant is one of the few big plants in the country almost entirely equipped with butterfly and cone valves. At this Filtration Plant, for instance, 66 R-S Rubber-Seated Butterfly Valves were specified for their ability to provide drop-tite, shut-off compactness and ease of operation. Satisfactory performance since the plant began operation in 1953 has resulted in an additional order of 42 R-S Rubber-Seated Butterfly Valves to rehabilitate the old Niagara Falls Filtration Plant.

Positive closure is assured by the wedging action of the valve disc periphery against a tough, flexible rubber seat, which seals the shaft bosses as well. Specially compounded rubber defies abrasion and resistance to the flow of materials for longer valve life.

If you would like to benefit by the design advantages and economics available in our complete line of butterfly, cone and ball valves, contact our local representative or write S. Morgan Smith Company, York, Pennsylvania.

S. MORGAN SMITH CO.

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Controllable-Pitch Ship Propellers

Carl A. Morse

Erwin S. Wolfson

New Diesel Officers

Morse elected president, Wolfson board chairman

In a major realignment of executive officers of the Diesel Construction Co., of New York City, Carl A. Morse was elected president of the general contracting and investment building firm, succeeding Erwin S. Wolfson, who was named chairman of the board.

Morse, with the firm since 1952 as vice president, supervised the construction of many postwar office structures erected in Manhattan. Formerly an executive of Bing & Bing, he was associated with that company for a period of 27 years following his graduation from Yale in 1927.

Wolfson, who has been president of the Diesel Co. since 1952, after 16 years as vice president, moves to the newly created chairman's office where he will develop overall policies and further the expansion plans of the various divisions of the company. He is a graduate of the University of Cincinnati.

In a third change, Paul Cone was named vice president of Diesel and will act as special assistant to the president and chairman.

The executive changes extend also to Diesel's subsidiary, Wolfson Management Co. William Zimmerman assumes the executive vice presidency to direct and coordinate that firm's real estate operations with the parent company.

Theorode Kirchner was elected vice president of Wolfson. He will supervise tenant and building employee relationships, in addition to being operational head of the building management department.

New Engineer Is Appointed To Head Ontario Road Bureau

Melbourne A. Elson, who was appointed Deputy Minister of Highways in May, 1954, after a reorganization of the Ontario Highway Department, has resigned to return to private industry.

He is succeeded as Deputy Minister by W. J. Fulton, 63, who has been director of planning and design for the department.

Elson said he will return to the construction company with which he was serving when called to the post more than two years ago—Russell Construction Co., Ltd., of Toronto. He will become a director and executive vice president of the company.

Fulton, a veteran with 35 years of service in the highway department, joined its staff in 1921. He will be succeeded as director of planning and design by John Walter.

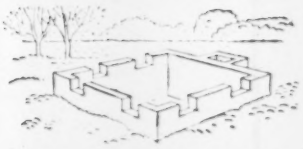
San Diego Sub-Contractors To Unite Under One Council

A Construction Industry Sub-Contractors Council has been formed to unite under one banner the several associations within the industry in San Diego county, Calif.

Scheduled to go into operation Mar. 1, the council aims to assist its affiliated associations in the development of better relations with labor, general contractors and with the public. It will assist federal, state and local government agencies with information relative to the day-to-day functioning of the industry.

Sub-contractors in the county account for the employment of over 11,000 construction workers and provide over $100 million annually in working capital.

(Men and Jobs continued on page 194)



EFCO FORMS
for house foundations

EFCO Steel Forms for concrete construction are adaptable to wide use by their owners, including construction of house foundations. Other advantages:

- **Lifetime steel faces should never need to be replaced.**
- **Easy to handle and assemble.**
- **Saves time, material, money.**
- **Low original cost.**

Other forms from Economy are available on a rental basis. Write nearest office for catalog.

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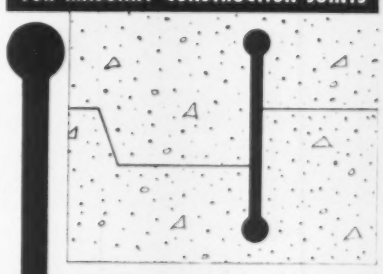
RUBBER WATERSTOPS
FOR MASONRY CONSTRUCTION JOINTS

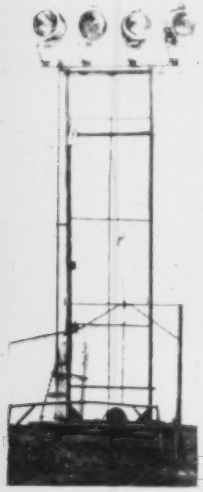


Williams Efficiency Waterstops are made from Natural Rubber Stock, and designed for maximum effectiveness in any type of cast-in-place construction joint. They will bend around corners—will not tear from shear action. Tensile Test: 3990 lbs.; Elongation Test: 650%. Available in rolls up to 80 feet in length. Field splicing is simple. Williams Waterstops can also be furnished in Neoprene for industrial uses where resistance to oil and other injurious wastes is desirable. These highly effective Waterstops are now in use in hundreds of industrial plants, commercial and public buildings throughout the country.

See Sweet's, or Write for Information.

WILLIAMS
EQUIPMENT and SUPPLY CO.
17928 Kinross, Birmingham, Michigan

TOWER MOUNTED
PROPANE FLOODLIGHTS



Skid mounted, 18-ft. steel pipe frame tower weighs 600 lb.

Light volume adjustable up to 6,000 c.p. per light. Boom elevation adjusted by winch.

Assembly of four lights operates 12 hours at full capacity on 20 lb cylinder of fuel, at fuel cost of 15 cents an hour.

Light instantly with match even in -40° temperature. Safe, totally weatherized.

Also available 4 to 8-ft. telescopic stands for individual lights.

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That Speeds Work and
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Chicago, Ill. Tampa, Fla. Houston, Tex.
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AGC Changes

H. E. Foreman resigns his Post as managing director

H. E. Foreman, Managing Director since 1940 of the Associated General Contractors of America, has asked to be relieved of his duties in that capacity effective April 1. Because Foreman's health makes it impossible for him to devote his full time to the position, the AGC executive committee has "regretfully" accepted the resignation. However, in recognition of his services, and in order to make further use of his experience, the committee has named Foreman Association Advisor, effective April 1.

John D. Marshall, AGC Executive Director since 1953, will assume the duties of the post being vacated by Foreman. It has also been announced that James M. Sprouse has been named manager of the Highway Contractor's Division of the AGC, and that Francis E. Twiss, formerly director of engineering, International Road Federation, has been appointed engineer advisor for the group.

"Doc" Foreman, a lawyer as well as an engineer, is one of the best known men in the construction field, and has been the industry's spokesman for many years. A native of Dayton, Ohio, Foreman was graduated in 1919 from Ohio State University with a B.S. degree in civil engineering. Following graduation he taught for one year at the university, and later worked as an engineer on construction jobs throughout the midwest. For some time prior to joining the AGC in 1928, he was connected with the Ohio State Highway Department.

In addition to his engineering degree, Foreman studied law at Franklin University, and was admitted to the Ohio State Bar in 1928. He has since devoted a great deal of time to the legal aspects of government regulations applicable to the construction industry. On many occasions, he has represented the industry before Congress and he is currently a member of numerous committees advisory to governmental agencies, including the Department of Commerce, Labor Department, the Conference on Industrial Safety, Bureau of Budget and Civil Defense Administration.

New Firm to Specialize In Water Resource Work

D. J. Bleifuss and L. A. Hostetter have announced formation of a consulting engineering firm in Sacramento to be called Bleifuss, Hostetter & Associates. The new firm will specialize in all phases of water resources engineering.

Both Bleifuss and Hostetter were formerly with International Engineering Co. in San Francisco and they participated in design of Aluminum Co. of Canada's Kemano project and the Tri-Dam project in California.

Also associated with the firm is Gordon H. Klippel, a registered structural engineer formerly with the California Division of Architecture. The firm will be equipped to undertake structural design work. Five additional registered engineers are on the staff and the firm will be able to design such work as highway and municipal water supply projects.

Gen. S. R. Harris, Jr., Joins St. Louis Engineering Firm

Maj. Gen. S. R. Harris, Jr., former commander of the Arnold Engineering Development Center, Tullahoma, Tenn., has joined Sverdrup & Parcel, Inc., St. Louis architectural-engineering firm. He is special assistant to the S&P president, Gen. L. J. Sverdrup.

Harris said he will do general-assignment work on S&P projects, now scattered throughout the world.

A native of Pittsburg, General Harris is a 1926 graduate of the U. S. Military Academy.

Men and Jobs Briefs . . .

Retirements—John B. Smith as superintendent of Public Works for the Borough of Glen Rock, N. J. . . . **John C. Allen** after 36 years service with Riverside Cement Co., Los Angeles . . . **Leo S. Hillebrand**, vice president and treasurer of A. Bentley & Sons, Toledo, Ohio, contractors, after 53 years of service.

(*Continued on page 198*)

FOUNDATION of Long Sault Dam where 700,000 yards of concrete will be poured by the contractor—Walsh, Perini, Morrison, Kiewit, Utah Companies, Massena, New York.

AGGREGATE TUNNEL CUTS COST OF VOLUME CONCRETE MIXING... ST. LAWRENCE SEAWAY PROJECT

Material handling is a major problem on projects such as the Long Sault Dam on the new St. Lawrence Seaway. Here is a job of such magnitude as to require more than 2400 cubic yards of concrete per day to keep the work rolling.

To handle the necessary aggregates, the contractor constructed, at some distance from the dam site, a tunnel within which a conveyor carries the aggregate to a batch concrete mixer. This tunnel, built right on the job with Commercial Shearing and Stamping steel liner plates, is large enough to accommodate the conveyor belt and walkway for feeder operators.

Placed at intervals in the tunnel roof are openings through which the aggregate flows by gravity from the stockpile directly overhead and which completely covers the tunnel. Feeders installed at intervals in the tunnel roof control the gravity flow of the aggregate from above.

Feeder operators working inside the tunnel control the material flow and selection of sizes to obtain the proper aggregate mixture reaching the conveyor. The belt carries the aggregate to the batch mixer for the addition of cement, water and mixing into concrete.

Commercial Shearing and Stamping liner plate was selected for this job because of its ability to withstand the most severe overhead loads, and to provide maximum protection from collapse and cave-in. In addition, the ease of constructing and disassembling Commercial liner plate tunnels make it possible to move or salvage the entire tunnel. This method of large scale aggregate handling, as done at the Long Sault Dam project, is being profitably used by contractors on other major projects.

Commercial Shearing and Stamping steel liner plate is available in a wide size and gauge range. For complete details on how Commercial can help solve your surface or sub-surface tunnel problems write to Dept. E-6. The Commercial Shearing and Stamping Company, Youngstown, Ohio.

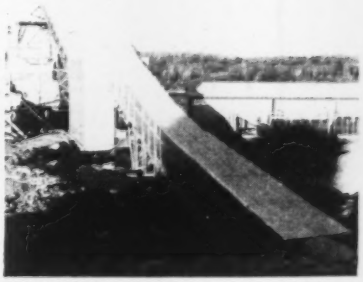
COMMERCIAL *shearing and stamping*

YOUNGSTOWN, OHIO
CHICAGO, ILLINOIS
SALT LAKE CITY, UTAH

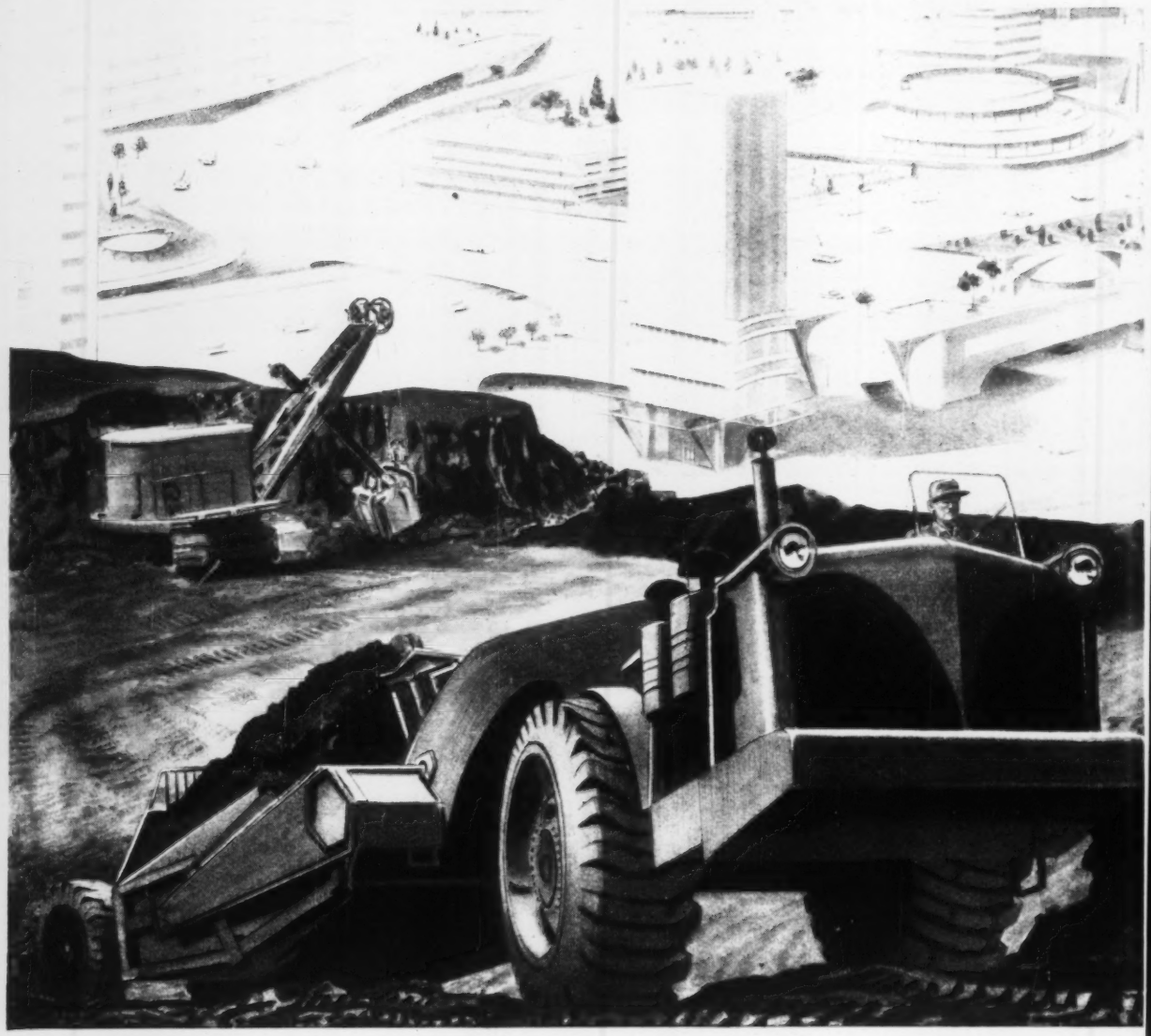
CONSTRUCTION of aggregate tunnel is quick and simple. Workmen install Commercial's liner plates on this concrete foundation in trench.

TUNNEL is completed. Unskilled workmen have used only 7 inside bolts to hold each plate. Note aggregate feeder openings.

AGGREGATE, stockpiled on top of tunnel, flows by gravity onto belt conveyor inside tunnel as operators open feeder gates.



CONVEYOR emerges from tunnel (foreground) and feeds aggregate into batch mixer for final processing into concrete. Trucks then haul concrete to dam site without time loss.



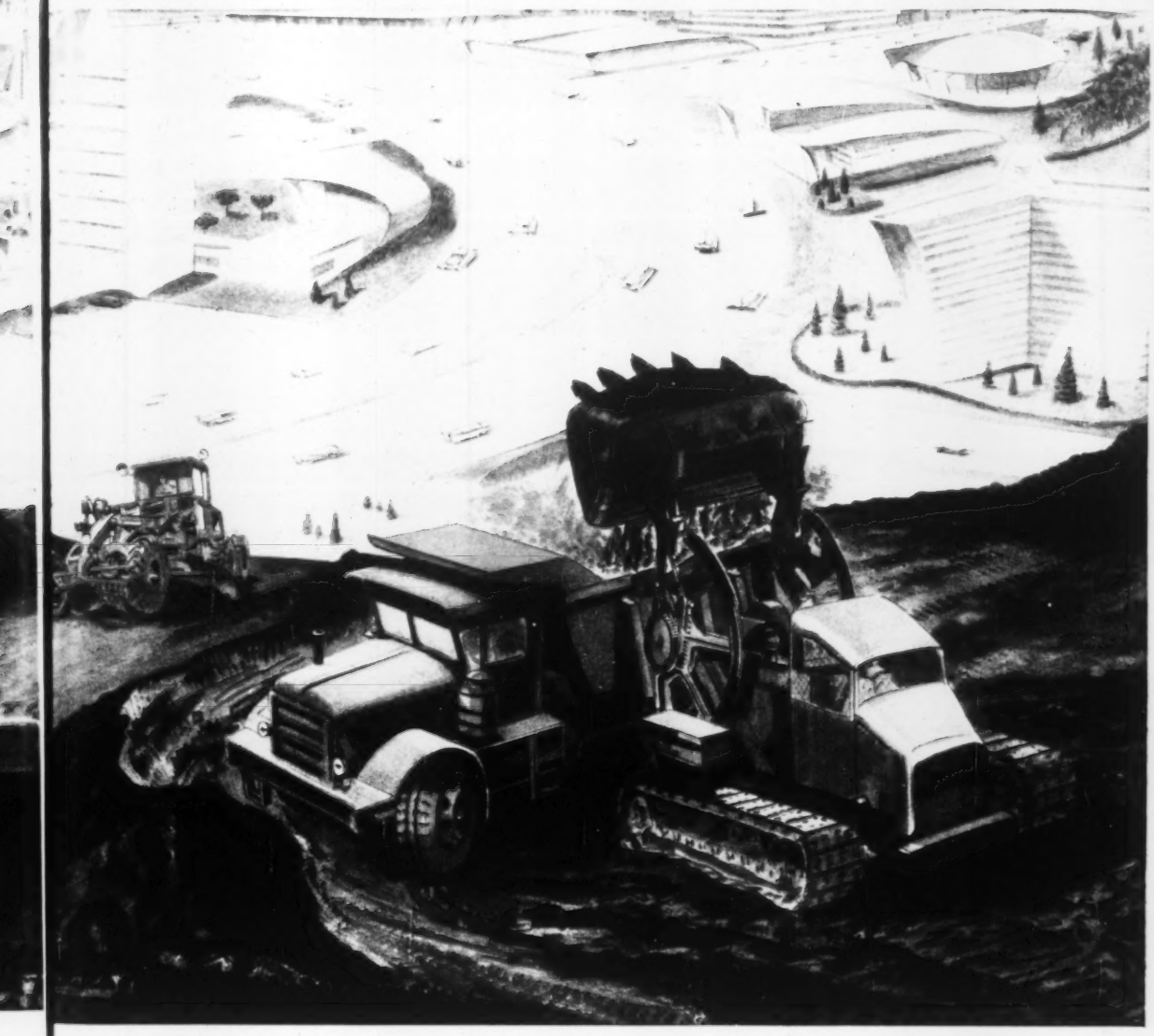
Multiplies muscles–*speeds*

COUNTRYSIDE, U.S.A. – from Cape Cod to the Golden Gate, from Mackinac to Mexicali – is being readied for the biggest "face lifting" job in history – for the great new network of turnpikes and throughways to serve the needs of an impatient motoring public.

"Operation Facelift" is underway – speeding today's byways into tomorrow's highways. And, pitting giant muscles against this tremendous task is the newest road-building equipment. For modern machines are the key to modern roads.

The *most modern* of these giant road-building machines have one point in common – TORQMATIC DRIVE. For manufacturers and contractors alike find TORQMATIC equipment works faster from first cut to final paving. TORQMATIC Converters match engine power to load demand – multiply torque for bigger "bites" with less strain. TORQMATIC Transmissions provide continuous full-power shifting–forward and reverse – for quicker completion of every job. And, TORQMATIC DRIVES make every machine easier to operate, reducing the need for extensive operator training.

122 kinds of construction equipment built by 55 different manufacturers are *now* available with



byways into highways

TORQMATIC DRIVE. You'll see many of them on display at the ARBA Show in Chicago. And, we'll be looking for you at the Allison TORQMATIC Display, too, where we'll show you how TORQMATIC DRIVES can give your equipment *new utility—new efficiency—new economy*. For further information, write: Allison, Division of General Motors, Box 894E, Indianapolis, Indiana.

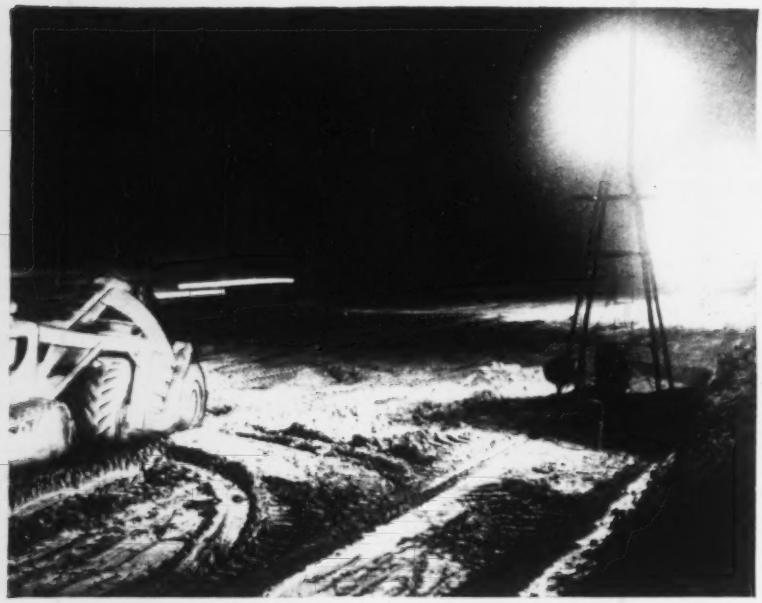
See you at the ARBA Show, Chicago, January 28 through February 2

Allison

TORQMATIC DRIVES

GM

TORQMATIC



ACRES OF DAYLIGHT

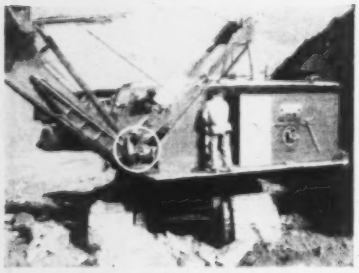
for the night shift with ONAN power

For night lighting on big projects an electric plant should combine high capacity with mobility . . . *high capacity* to handle a bank of powerful floodlights . . . and *mobility* to simplify frequent moving on the job site.

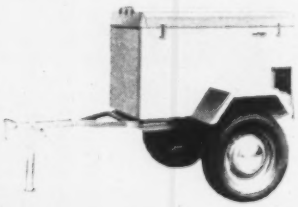
The Onan 10CW electric plant meets both requirements: It delivers 10,000 watts A.C., yet it weighs only 800 pounds. It is completely Onan-built, with a heavy-duty Onan 2-cylinder, gasoline engine direct-connected to an Onan all-climate generator in a permanently-aligned, compact, long-life unit. Starts instantly in any weather. Air-cooling eliminates trouble from freezing or leaking coolants. Available also as a 7,500-watt unit.

Put these mobile, high-capacity units to work on your next lighting job.

Onan 10CW mounted on a portable, skid-mounted floodlight tower. This unit is being used for night operations on a St. Lawrence Seaway project.



Onan 3KW Series 3DSP Diesel electric plant mounted on shovel—lights cab and work area.



Trailer-mounted 10CW. Tow it anywhere behind car or truck. Weatherproof housing.

500 to 75,000 watts

Lightweight, portable, gasoline-powered plants: 500 to 10,000 watts. Water-cooled plants: 10,000 to 75,000 watts. Air-cooled Diesel Plants: 3,000 and 5,000 watts.

See us at the ROAD SHOW in CHICAGO

Members: AED and IRF

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

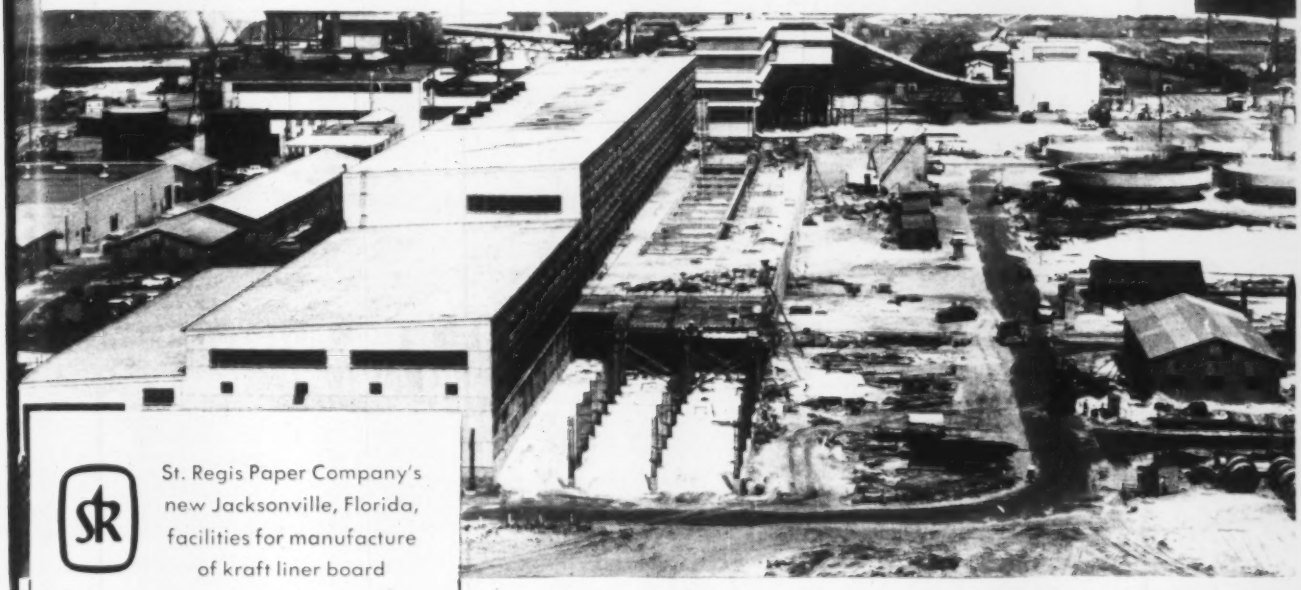
3039 University Ave. S.E., Minneapolis 14, Minnesota

Men and Job Briefs . . .

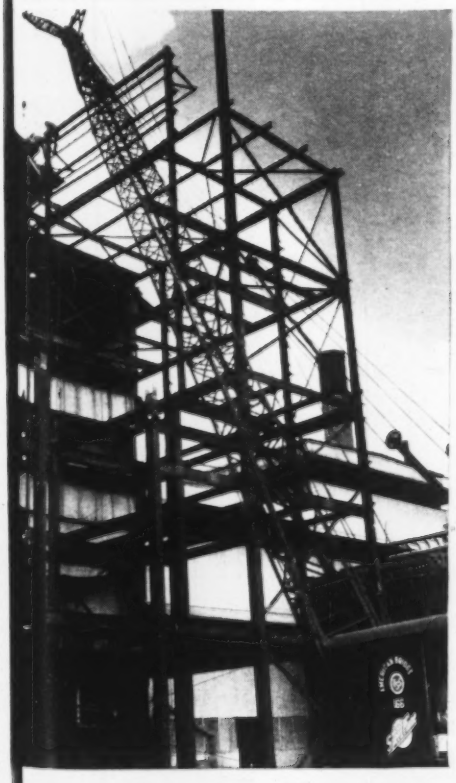
• **Careers** Roland A. Bennet has been named Deputy Commissioner of the Connecticut State Highway Department to succeed **Howard S. Ives,** who has retired. A veteran of 32 years service in the department, Bennet has been employed by the state since shortly after graduation from Middlebury College in Vermont . . . Appointment of **William K. Clayton** of Philadelphia as director of the Bureau of Engineering and Construction of the Pennsylvania Department of Property and Supplies has been announced. Clayton, formerly a district engineer at the Norristown office of the department, succeeds the late **C. E. Strausser** . . . **A. F. Ghiglione,** head of the former Alaska Road Commission, has been appointed acting division head of the U. S. Bureau of Public Roads at Juneau, Alaska. He succeeds the late M. M. Flint who had been appointed to the post when the Commission was merged with when the Commission was merged with the Bureau a short time ago . . . **Frank E. Elliot** has been designated chairman of the board of Crane Co. and will be succeeded as president of the company by **Neele B. Stearns,** currently vice president of Inland Steel Co. . . . **James R. Libby,** former chief engineer of Freyssinet Co., and **Enis Y. Baskam,** former associate of Praeger-Kavanagh, Consulting Engineers, have formed a partnership under the name of Libby-Baskam, with offices in East Norwich, N. Y. . . . **Frank T. Matthias,** who built the Hanford, Wash., atomic project during World War II, has been named chief engineer of the Aluminum Company of Canada . . . **Oswald Speit,** who recently retired from the Corps of Engineers after 22 years service, has been named supervising hydraulic engineer for the California Department of Water Resources . . . **J. Richard Mills,** an engineer for American Gas & Electric Co. for the last 20 years, has been named resident engineer for the construction of a new Indiana & Michigan Electric Co. plant . . . **Tom E. Cunningham,** city manager of Southern Pines, N. C., has resigned to accept a teaching position in La Paz, Bolivia . . . **Francis Connors,** at present city engineer of Van Wert, Ohio, will enter private engineering practice Feb. 1 . . . **Clifford W. Morgan** has been appointed general manager and secretary of the Hamilton Harbor Commission in Hamilton, Ont. . . . **Archibald J. Allen,** formerly with the Ohio Turnpike Commission, has left for Seoul, Korea, to become senior advisor to the Korean minister of communications.

(*Continued on page 200*)

Down in Jacksonville—where St. Regis is spending $40,000,000 to expand its facilities



St. Regis Paper Company's new Jacksonville, Florida, facilities for manufacture of kraft liner board



-we're building a paper mill of steel!

With a modern pulp and paper mill located near Jacksonville, Florida, completed in 1952, already producing 350 tons of kraft paper and paperboard daily, St. Regis Paper Company is currently investing $40,000,000 in additional facilities which will enable the Jacksonville mill to produce an additional 1,000 tons of kraft linerboard per day.

This is a big project involving the use of 5,000 tons of structural steel for the many large buildings and other structures required for the modern mill. All of this steel was fabricated and nearly all of it was erected by American Bridge.

The vast new mill was designed by J. E. Sirrine Company, Engineers, of Greenville, S. C., and Stevenson and Rubens, Consulting Engineers of Seattle, Wash. Tidewater-Auchter was the general contractor for the project.

In constructing this new mill for St. Regis, American Bridge utilized its experience, knowledge and skill to the advantage of everyone concerned with the project. All steelwork was erected with maximum speed, precision, economy and safety.

For detailed information regarding your structural steelwork requirements, please contact the office nearest you.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.

Contracting Offices in: AMBRIDGE · ATLANTA · BALTIMORE · BIRMINGHAM · BOSTON · CHICAGO · CINCINNATI CLEVELAND · DALLAS · DENVER · DETROIT · ELMIRA · GARY · HOUSTON · LOS ANGELES · MEMPHIS MINNEAPOLIS · NEW YORK · ORANGE, TEXAS · PHILADELPHIA · PITTSBURGH · PORTLAND, ORE. · ROANOKE ST. LOUIS · SAN FRANCISCO · TRENTON · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

AMERICAN BRIDGE

UNITED STATES STEEL

Schramm Truck Mounted Rotadrill drives right to the drill site—often where bigger rigs can't go. Drilling is a one-man operation; simply lower out-riggers, raise mast and attach drill pipe and bit.

CONTRACTORS TELL US:

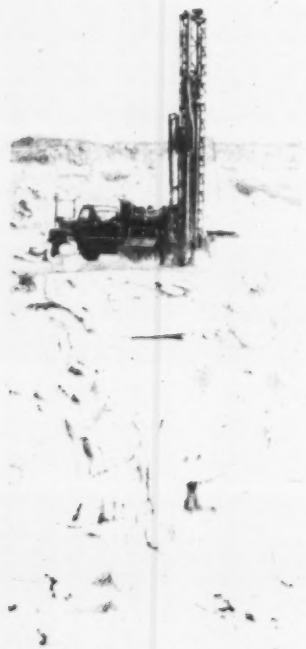
"Faster than bigger rigs . . . goes where they can't"

You don't have to sacrifice drilling speed to gain maneuverability. With a Schramm Truck Mounted Rotadrill, you get both. Field tests prove that Rotadrill makes hole 600% to 700% faster than conventional drill rigs. Yet its relative lightness permits it to work where big rigs can't go . . . at the edge of a cliff, for example.

Reason is that there's nothing unwieldy about the Truck Mounted Rotadrill. It needs no ponderous machine to transport or power it—it's self-propelled. Also, it has no cumbersome superstructure to be erected and dismantled. Rotadrill's drilling speed comes from regulated hydraulic down-pressure (up to 25,000 pounds) and immediate, continuous chip removal by compressed air. Because the kelly bar and rotation table are eliminated, the adding or removal of steels from the string takes less than 5 minutes.

Ease of transportation is built into Rotadrill. So is fast set-up. And because Rotadrill cleans the hole continuously with compressed air, bit life is prolonged. Bulletin TMR-55 gives complete details of the Schramm Truck Mounted Rotadrill. Be sure to write for your free copy—along with our Bulletin, "Rotary Rock Drilling with Schramm Air Compressors." It's a mine of drilling information.

Your local Schramm Dealer is listed in the Yellow Pages of your telephone directory



Oversize truck engine (450 cu in.) drives 3½" x 4¼" x 6 cylinder Schramm Compressor through power take-off. Compressor delivers 320 cfm at 40 psi. This can be instantly increased to 200 psi for dewatering and breaking out blockages.

Schramm, Inc.

MANUFACTURERS OF AIR COMPRESSORS

620 North Garfield Ave. West Chester, Pa.

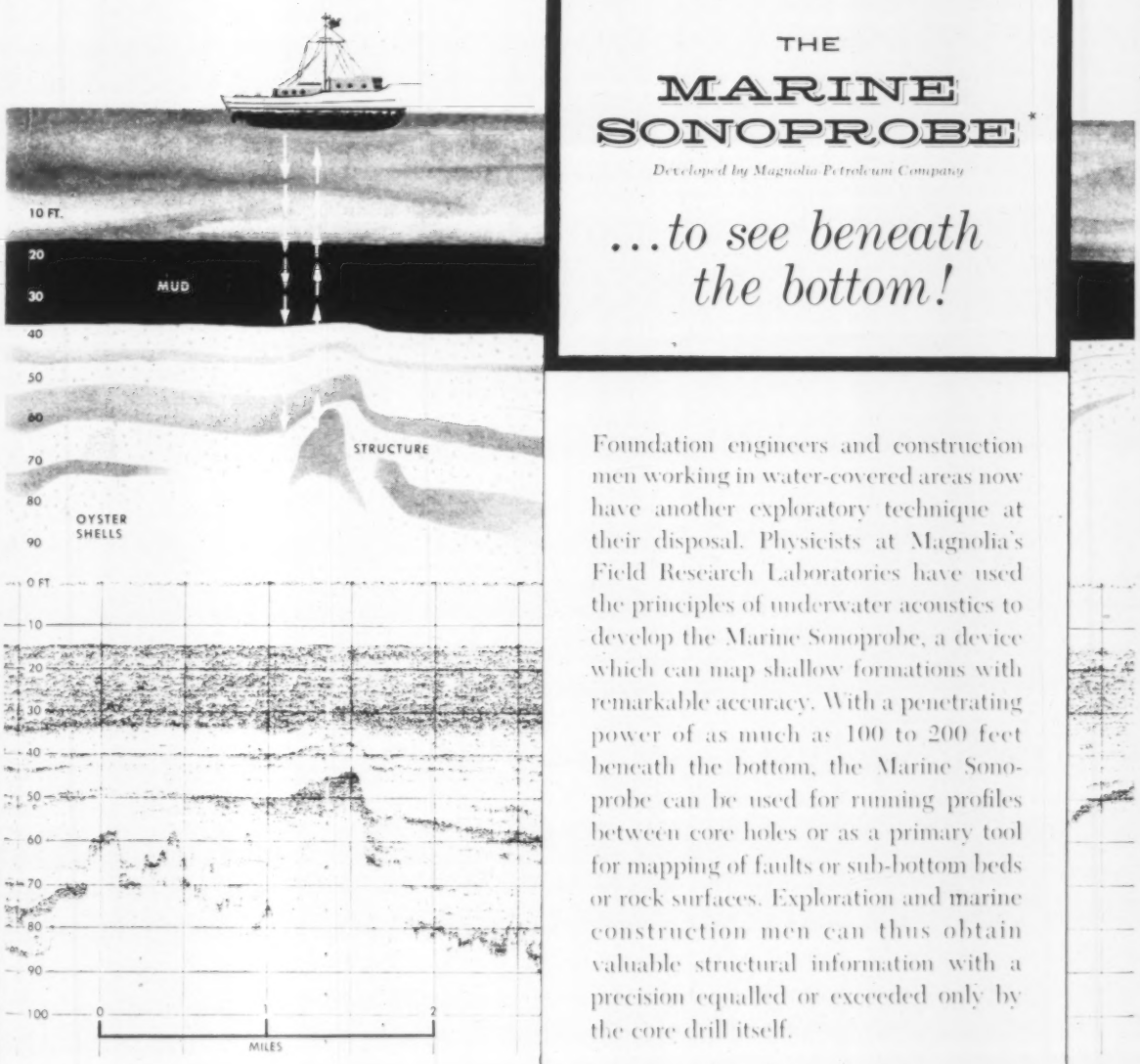
Men and Jobs Briefs (Cont.)

Associations—The Ohio Contractor's Association elects **G. Gordon Brode**, Newcomerstown, as new president. . . . **Morton Macht**, president of Welsh Construction Co., Baltimore, elected president of the Home Builders Association of Maryland. . . . **J. H. Walker**, president of Linfield Engineering Co., Marion, Ohio, elected president of the Conveyor Equipment Manufacturers Association. . . . **C. E. Proudley** of Raleigh, N. C., engineer with the North Carolina Highway Department, elected president of the Central Carolina Chapter of Professional Engineers. . . . **Edwin L. Jones**, president of J. A. Jones Construction Co., of Charlotte, N. C., has been named chairman of the subcommittee on industry and labor of a Nuclear Energy Advisory Committee for the State of North Carolina. . . . **George C. Koss**, president of Koss Construction Co., Des Moines, elected president of the Greater Des Moines Chamber of Commerce. . . . **Robert H. Meyers**, Evansville, has been elected president of the Home Builders Association of Indiana. . . . **Dr. Arthur F. Burns**, who resigned Dec. 1 as chairman of the President's Council of Economic Advisors, elected president of the National Bureau of Economic Research. . . . **William F. Mink** elected chairman of the industries section of the Delaware State Chamber of Commerce. . . . **Ken Norrie**, elected president of the Spokane, Wash., section of the ASCE. . . . **F. J. Blythe, Jr.** of Charlotte, N. C., elected president of the Carolinas Branch of Associated General Contractors of America. . . . **Stephen J. Gabay**, president of Berwick Realty Co., elected president of the Columbus, Ohio, Home Builders Association. . . .

Retirements—After 23 years service with the Bureau of Reclamation, **Ben F. Powell** of Pueblo, Colo. . . . **George M. Keenan**, vice president and director of Pennsylvania Power & Light Co., after 38 years of service . . . **Chester A. Niple**, founder and partner in the Columbus, Ohio, engineering firm of Burgess & Niple, as city engineer of Upper Arlington after 30 years . . . **Herbert Appleby**, vice president of Detroit Steel Corporation, after 21 years service . . . **David E. Austin**, executive vice president of U. S. Steel, after nearly 39 years with the company. . . .

Honors—The New York Society of Architects honor **Charles R. Ellis**, architect of Syracuse, N. Y., with the Sidney L. Strauss Memorial Award for 1956 in recognition of his past service for the architectural profession.

ANNOUNCING...A MAJOR NEW CONSTRUCTION AID



THE

MARINE SONOPROBE*

Developed by Magnolia Petroleum Company

...to see beneath the bottom!

Foundation engineers and construction men working in water-covered areas now have another exploratory technique at their disposal. Physicists at Magnolia's Field Research Laboratories have used the principles of underwater acoustics to develop the Marine Sonoprobe, a device which can map shallow formations with remarkable accuracy. With a penetrating power of as much as 100 to 200 feet beneath the bottom, the Marine Sonoprobe can be used for running profiles between core holes or as a primary tool for mapping of faults or sub-bottom beds or rock surfaces. Exploration and marine construction men can thus obtain valuable structural information with a precision equalled or exceeded only by the core drill itself.

*trademark

Now available to the construction and oil industries through

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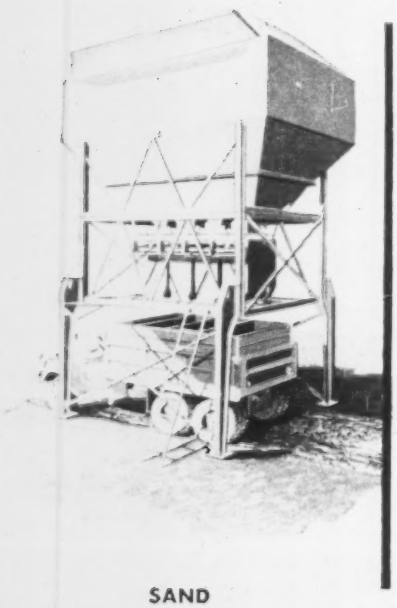
A WORLD'S FIRST . . .

One-Man

HANDLES 4

New BUTLER TX-4 SYSTEM



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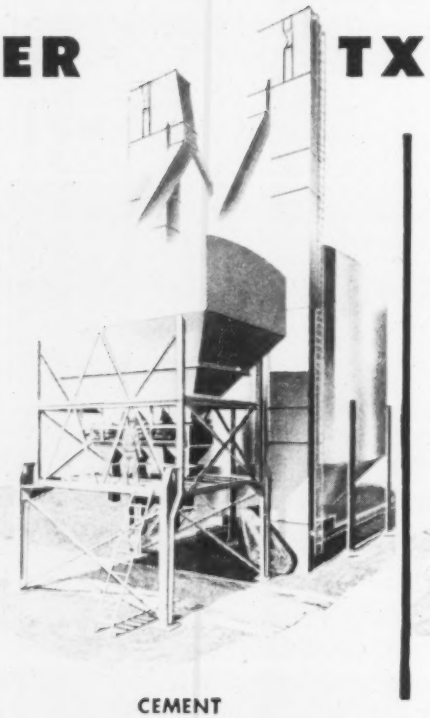
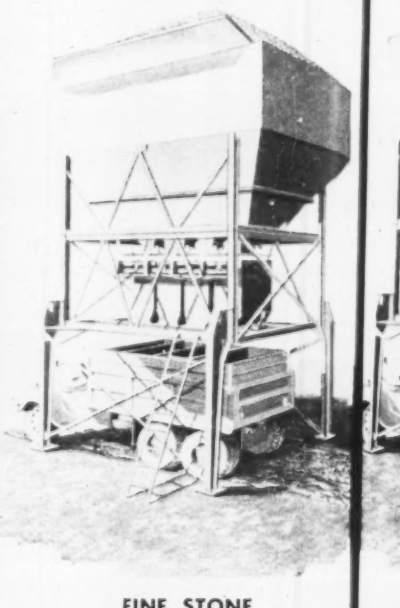
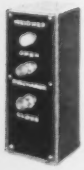


CEMENT



FINE STONE

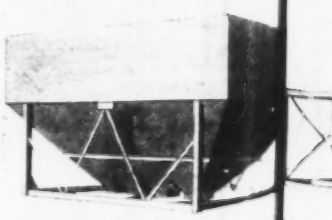
Designed for ULTRA HIGH SPEED BATCHING—for Four Pavers and wi NL



Batchers are pre-set for any specification and controls are mounted on aggregate bins so that batching is controlled automatically and discharge handled by the truck driver as he passes under the bins. All push button controls for all plants can be operated by the single batcher man located on the cement platform. Interlocking is built into the system so no set of batchers can be discharged until proper weights are reached, and no batchers can be filled until all materials are completely discharged.

Maximum Portability in Roa Bui

The new BUTLER TX-4 Batching System has many built-in features that assure easier erection, dismantling and moving. Designed with a minimum of units, pre-assembled, they require only simple bolting in the field, and piping or wiring. Bin sections are shipped in one piece, batcher sections shipped with wiring and piping attached. All wiring and piping in the field are done with special quick connectors. And the TX-4 is the only road builders plant with generous clearance for trucks.



Bins are completely pre-asse o or bled for easy crane handli pped, with hinged columns. ed w g in pl

PIONEERS IN **AUTOMATION** FOR READY MIX, ROAD BUILDERS AND CONCRETE PLTS

Operation

BATCHES SIMULTANEOUSLY

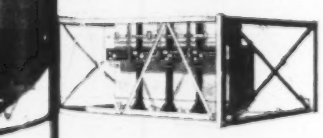
New BUTLER TX-4 Keeps Pace with FOUR 34E Dual Drum Pavers

Here's new engineered Automation so flexible, so fast, so dependable that it *obsoletes* all existing roadbuilders' plants. It's the new BUTLER TX-4 System, the modern batching plant that every contractor today *needs* to compete successfully. The contractor with only one paver starts with a TX-4 plant equipped with 2 batchers, and, as he expands with the road program, he simply adds additional batchers to the *same bins* to take care of 2, 3 or 4 pavers — and still retaining ONE-MAN OPERATION!

COARSE STONE

wi NLY ONE OPERATOR

RoBuilders Plant



wo or four-batcher units are pped, handled, moved and red with all piping and wir- in place.

How BUTLER TX-4 System fits Your Expansion Plans

THE BASIC UNIT

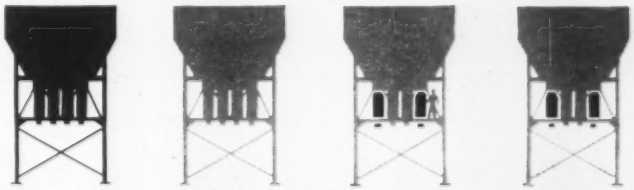
Handles one or two-batch trucks simultaneously

This Basic Plant, at minimum investment, provides facilities for batching for two-batch trucks — with one operator.

COARSE STONE FINE STONE CEMENT SAND

E-X-P-A-N-D-E-D UNIT

By merely adding extra batchers, at minimum extra cost, the Expanded Unit handles three or four pavers working at optimum production, charges 3- or 4-batch trucks



COARSE STONE FINE STONE CEMENT SAND

Write for FREE copy of this Bulletin giving complete details and specifications on every phase and feature of the new BUTLER TX-4 Road Building Systems.

BUTLER BIN CO.

969 Blackstone Avenue
Waukesha, Wisconsin

Maybe...
IMPORTED STEEL
is the answer to your problem!

WHEREVER YOU ARE, IT'S EASY TO FIND OUT...

What, IMPORTED steel — when America produces so much? You may be surprised to learn that many steel users, needing steel badly and facing questions of long waits, delayed shipments and rising prices, have discovered that IMPORTED STEEL, under certain circumstances, IS the answer to many problems.

So if you have a steel problem and you think that perhaps IMPORTED STEEL can help you . . . don't hesitate.

"Call the Institute," or the nearest Member for complete information. Every Member of the Institute has been chosen for reliability and can be depended upon to render fullest cooperation. There is one near you.

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350 FIFTH AVENUE, NEW YORK 1, NEW YORK
WIsconsin 7-8522

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AMERLUX STEEL COMPANY
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ARTCO INDUSTRIAL COMPANY, INC.
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WM. H. MULLER & COMPANY, INC.
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KURT ORBAN COMPANY, INC.
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WALTER H. ROTHSCHILD & CO., INC.
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AMERICAN MANNEX CORP.
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TUTEUR & COMPANY, INC.
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Obituaries

John F. Covert, 75, a civil engineer and hydraulics expert, died Dec. 23 in El Cajon, Calif. A former engineering inspector for the Public Works Administration and an engineer for the State of California, Covert also had worked for the cities of Santa Monica, Oceanside and San Diego as well as various water companies.

Perry A. Beam, 75, who retired recently after more than 35 years as an engineer with the Bureau of Public Roads, died Jan. 2 in Denver. He received his civil engineering degree from the University of Maine and before joining the Bureau, was with the Interstate Commerce Commission as an evaluator of railroad property.

Howard M. Gifft, 48, head of the sanitary engineering department in the Cornell University school of civil engineering and newly appointed dean of the university faculty, died Dec. 20. Formerly an engineer in the Iowa Highway and Conservation Commission and a teacher at Iowa State College, he had been at Cornell since 1941. He was a graduate of Iowa State College.

Harry M. Beamer, 73, a construction engineer for the Pennsylvania Turnpike Commission, died Dec. 24 at Drexel Hill, Pa. Before going with the commission he had been associated with Standard Oil Co.

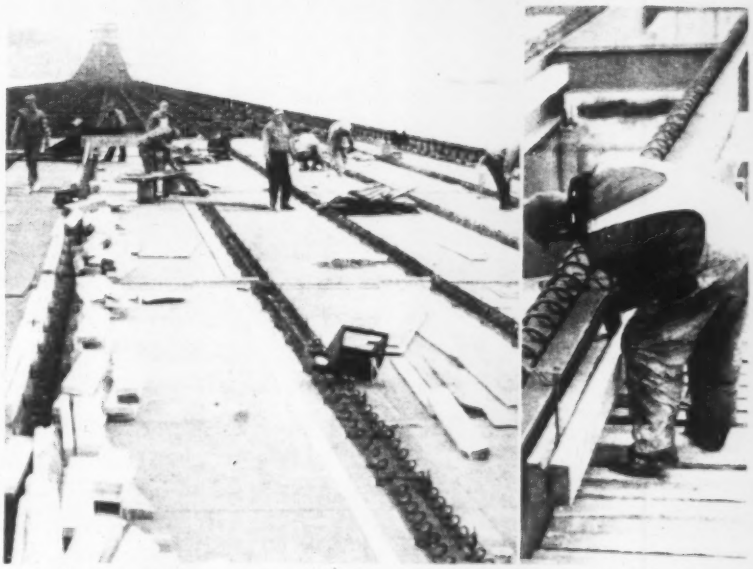
J. Preston Irwin, 67, an engineer for Arthur G. McKee & Co. of Cleveland, died Jan. 1. He was graduated from Washington and Lee University in 1908.

Albert E. White, 72, director of the University of Michigan's Engineering Research Institute from its inception in 1920 until he retired in 1955, died Dec. 18 in Ann Arbor, Mich.

Howard W. Jones, former right-of-way engineer for the Delaware State Highway Department, died Jan. 4 in Dover, Del.

Leroy C. Harman, 58, district engineer for the Chesapeake & Ohio Railway, died Dec. 30 in Richmond, Va. He attended the University of Virginia and joined the railroad in 1931.

Ralph D. Stauffer, 58, president of NEGEA Service Corp. of Cambridge, Mass., died Dec. 31 at Cambridge. He formerly held the position of chief engineer for Gilbert Associates of Reading, Pa.



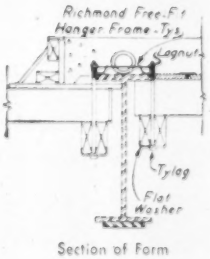
Left: Erecting bridge deck forms. Right: Using Richmond Free-Fit Hanger Frame-Tys, workmen fasten walers from above. Contractors: Garofano – West-Shore – Euclid. Engineers: Madigan-Hyland.

"Fast forming method & Richmond Hanger Frame-Tys speeded up Tappan Zee deck paving"

Charles Spero

The 6-lane deck of the New York State Thruway Authority's 3-mile long Tappan Zee Bridge took 33,000 yards of concrete and considerable ingenuity. A combination of stock-size plywood sheets, filler strips of wood and metal, and Richmond Free-Fit Hanger Frame-Tys helped get the bridge open early.

Euclid's construction boss, Charles Spero, says they saved lots of time and money by hanging the forms with Richmond Free-Fit Hanger Frame-Tys —45,430 of them. Since the Richmond Tylag passes through an over-size coil and is adjusted by a nut on the upper end, the forms can be handled from above. "These Richmond Hangers speed up the whole operation," Mr. Spero points out. "You don't have to build a lot of scaffolding, work under the deck and risk accidents. The forms are quickly assembled, and easy to take out, too. And there's hardly any repair work to be done.



Section of Form Construction

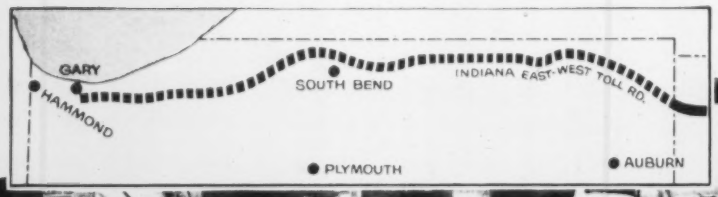
"What's more, they're more economical when you figure the cost per foot," says this veteran Euclid superintendent. "A lot of fellows who use wires forget to figure the hidden costs —they don't stop to think about the labor putting in the wires and, later, the patching. With wages going up all the time, those savings keep getting bigger."

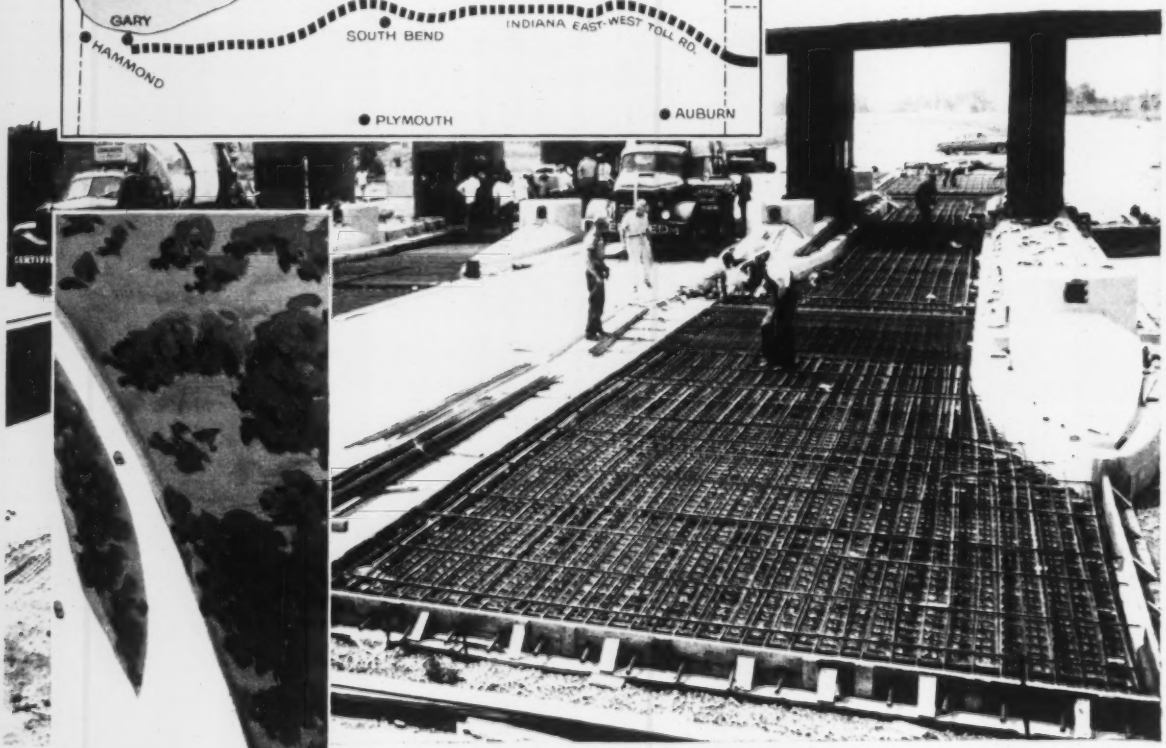
Richmond Free-Fit Hanger Frame-Ty

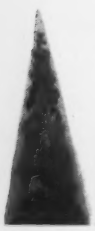
Richmond also makes a standard type Hanger Frame-Ty with two helix coils. For use where a slab is haunched to meet the top flange of the steel beam, Richmond makes Offset Hanger Frame-Tys with coils high enough above the top of the beam to permit the metal to be properly set back from the concrete. Richmond Fascia Hanger Frame-Tys combine hanger and fascia-tys for use on outside girders of bridge decks.

All these—along with the complete line of Richmond engineered tying devices, anchorages and accessories—are described in the new Richmond Handbook. To get your copy—or help on a specific concreting problem — write to RICHMOND SCREW ANCHOR COMPANY, INC., 816 Liberty Ave., Brooklyn 8, N. Y. or 315 So. Fourth Street, St. Joseph, Mo.

NEW...Snow-and-Ice-Free Interchanges on Indiana's East-West Toll Road







with Steel Pipe Snow Melting Systems

"Really *new* and *important*"..."an *innovation* in highway construction" . . . are some of the things said about the Steel Pipe Snow Melting Systems installed at gates and interchanges on the recently opened Indiana East-West Toll Road. That they will add immeasurably to bad weather safety factors and increase the traffic handling capacities at these vital points of entry and exit is the opinion of highway engineers.

With the forthcoming expansion of the nation's highway systems, roadbuilders in the snow belt should give serious consideration to the advantages of automatic snow and ice melting in highway construction . . . for interchanges, bridge floors, elevated ramp sections, over-passes, and other exposed road sections where conventional control methods may be both costly and inadequate.

For such installations, *Steel Pipe is first choice*, as in this Indiana road, the elevated approach to the New York Port of Authority bus terminal, the Staten Island Ferry Ramp, and many others. Yes, steel pipe is the most widely used pipe in the world, for snow melting, radiant heating, plumbing, fire sprinkler systems, power, steam, air transmission and electrical raceways.

Write today for free booklet "Steel Pipe Snow and Ice Removal Systems."

Steel Pipe is First Choice

Committee on
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AMERICAN IRON AND STEEL INSTITUTE
150 East Forty-Second Street, New York 17, N.Y.

Paver puts down asphalt base over wire fabric, as Houston engineers . . .

Save Million on Airfield Paving

A relatively new method of resurfacing battered runways and taxiways has resulted in a reported saving of more than $1 million at Houston's International Airport.

The method is aimed at salvaging rather than replacing the damaged runways, and is said to be particularly useful for airports with runways constructed 10 to 15 years ago.

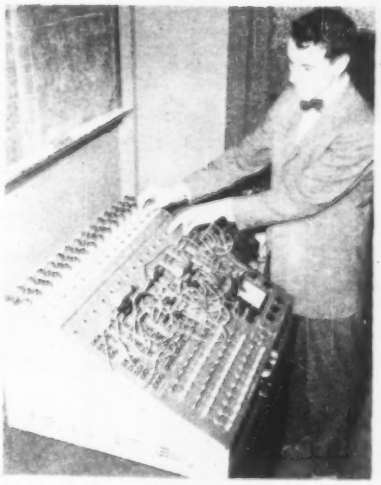
The contract was let to the Gulf Bitulithic Company, and called for 50,000 tons of asphaltic concrete and 200,000 pounds of welded wire fabric to provide for 9,000 lineal feet of runway, 150 feet wide, and 1,600 lineal feet of taxiway, 74 ft wide.

Some 3,155 yards of badly broken concrete of the old runways was removed and replaced with concrete containing oyster shell as coarse aggregate. The asphalt overlay operation consisted of first laying one inch of Type "E" (sheet asphalt), topping that with 6-by-6-inch No. 10 wire fabric which was topped, in turn, by 3 inches of Type "A" asphaltic concrete and the whole overlaid with one inch of Type "D" asphaltic concrete, with crushed limestones used as an aggregate throughout.

Before paving, the center 70 feet of the runway was completely covered with wire fabric mats 10½ by 20½ ft. On the outside 40 feet of the runway, 5-ft by 10½-ft wire fabric mats were placed over the transverse joints. All mats were lapped 6 in.

The work was started September 1, under the supervision of the Public Works Department of the City of Houston.

The resurfacing method used was pioneered at the Willow Run Airport near Detroit.



"Build-It-Yourself' Computer Now in Use at Iowa College

An analog computer has been assembled, from parts supplied by a commercial manufacturer, by Professors Paul W. Peterson and A. H. Hunrath on photo of the Department of Mechanics at Iowa State College. It cost only $950 exclusive of assembly, which required over 400 manhours.

Many mechanical, chemical and structural engineering problems are being solved by the computor, which relates voltages to the physical parameters of the problem. The solution appears as a voltage that can be observed on recorder, voltmeter or oscilloscope.

This computor, which is one of the first available for the instruction of engineers, is about 30 x 40 in. in size and sits on a table top.

The computor is being used both for instruction work in graduate courses and for solution of research problems.

Mercury Vapor Lights Credited With Saving at St. Lawrence

Constructors of Grass River Lock, on Long Sault Canal of the St. Lawrence Seaway, placed as much concrete by night as by day this past season under mercury vapor flood lighting.

Electrical Superintendent John Pate says that a total of 120 1,000-w incandescent floodlights would have been needed to equal the illumination by 44 1,000-w mercury vapor units. They produced 3 to 5½ footcandles over the work area.

Pate figures installation and maintenance costs were paced 55% by the choice of lighting equipment.

Although common on highways and in factory interiors for years, the mercury vapor lighting at Grass River Lock was considered experimental by Crouse-Hinds, the manufacturer.

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In drafting rooms throughout the world Imperial quality is the standard by which fine tracing cloths are judged. This has been true for decades, and Imperial remains the finest tracing cloth because its makers have continued to improve its quality and value.

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Percentage variation caused by moisture or temperature less than .000405.

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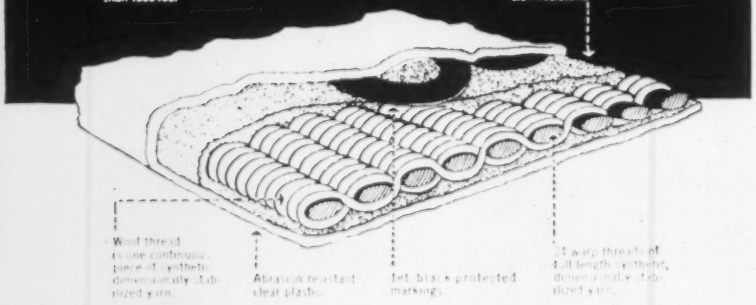

Here's a woven tape that approaches the accuracy of metal tapes. Made from continuous, synthetic, dimensionally stabilized fibres that are non-conductive and have high dielectric strength. The thirty-four lengthwise warp strands are interwoven with endless cross strands so that there are no ends to fray on the edges. Attractive leather case with rust-resistant steel liner. 25 to 150 foot lengths.

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Research

New Pickle-Liquor Treatment Recovers 50% of Spent Acid

Another pickle liquor waste treatment process follows on the heels of the Blaw Knox method reported in ENR Sept. 20, p. 25. The new process is a commercial adaptation of a technique developed by Zahn & Co. of West Berlin, Germany. Exclusive U. S. and Canadian rights have been assigned to Koppers Co., Inc. by the patent holder, Inland Steel Co.

A continuous cycle recovers and regenerates the sulfuric acid and water solution which, after cleaning scale and other impurities from finished steel, ends up as an iron sulfate solution. In the new process, the spent pickle liquor first goes through a spray dryer where a hot air jet drives off the water. This leaves a slurry of iron sulfate crystals suspended in concentrated sulfuric acid. The crystals are separated from the acid by centrifuging or filtering. The concentrated acid is then diluted with water and reused.

Up to 50% of the sulfuric acid used in the pickle liquor is recovered, according to W. C. Rueckel of Koppers.

How Much Digester Liquor Can Trickling Filters Take?

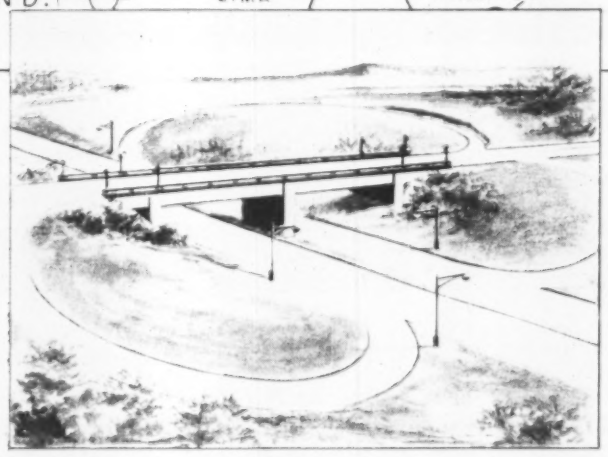
Researchers at the Texas Engineering Experiment Station, College Station, report very encouraging preliminary results in determining how heavy a dosage of supernatant liquor from sludge digesters can be applied directly to trickling filters. Investigators J. H. Sorrels and P. J. Zeller find that dosages can be much heavier than those normally applied.

Many cities in Texas, and in the nation at large, are experiencing difficulties in returning digester liquor to the plant influent line. Those possessing trickling filters may be able to ease their problems if final results of the TEES studies bear out the preliminary findings.

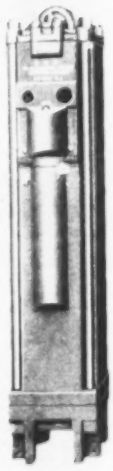
Promotion of Plastic Pipe

Following four years of research on plastic pipe, the Pipe Research and Education Committee of the Society of the Plastics Industry, Inc., in cooperation with the National Sanitation Foundation, is embarking on a program of plastic pipe promotion aimed primarily at the general public.

The research project established that plastic pipe is healthsafe for transporting drinking water. And as proof of this, the NSF has allowed its Seal of Approval to be placed on plastic pipe.



282 BRIDGES IN 241 MILES ON THE OHIO TURNPIKE



...and McKiernan-Terry a popular choice for pile driving

The many bridges which carry intersecting highways over or under the Ohio Turnpike are quite similar in design. Of interest are the many instances in which unrelated contractors chose McKiernan-Terry Pile Hammers to drive the piles for the abutments and the piers all along the 241-mile length of the turnpike.

In the construction of turnpikes and thruways in New York, New Jersey, Pennsylvania, Indiana, New England and other sections of the country as well, McKiernan-Terry pile-driving equipment has helped contractors do their portions of the projects speedily and economically.

Write for bulletins on the extensive McKiernan-Terry line of single-acting and double-acting pile hammers, double-acting pile extractors, pile hammer leads and accessories.

BUILD BETTER ROADS TODAY FOR A GREATER AMERICA — See you at the ROAD SHOW CHICAGO Jan 28 Feb 2 1957

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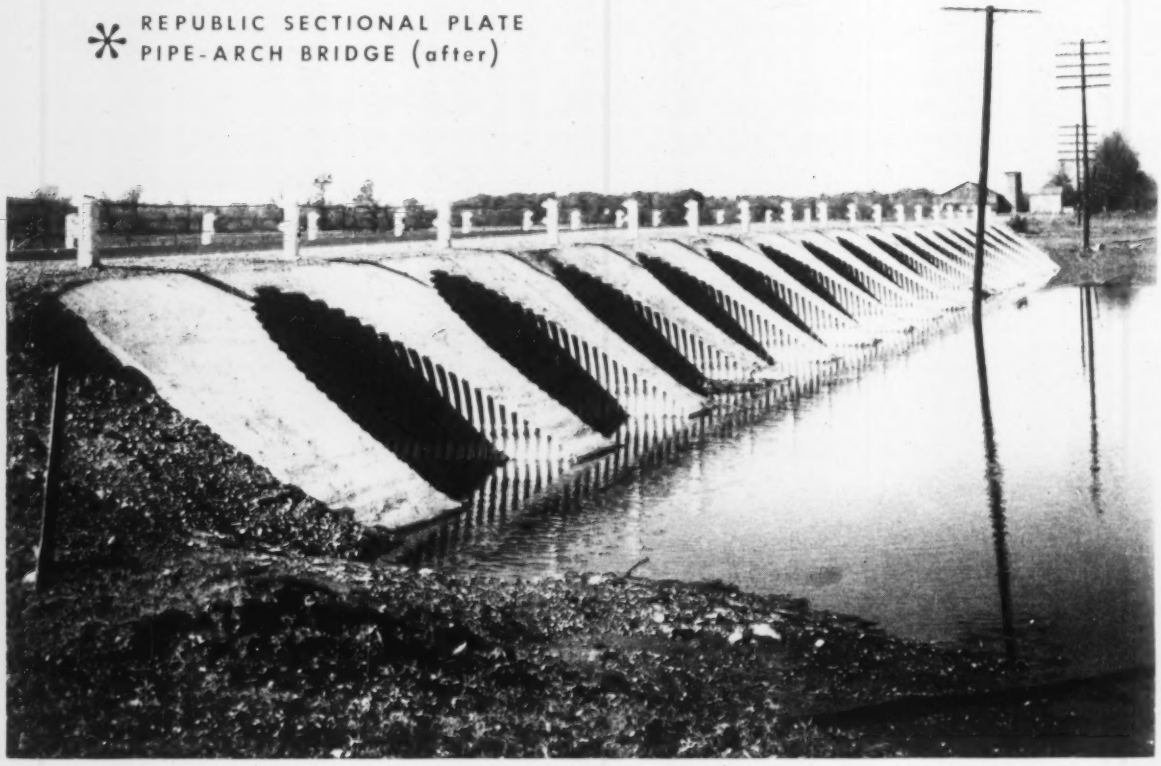
MK 376

ANTIQUE BRIDGE (before)

* REPUBLIC SECTIONAL PLATE PIPE-ARCH BRIDGE (after)

when



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Count the expense of continual maintenance, traffic delays and detours, depressed land values, increased hazard to life and property. These are the costs of an antique bridge. Some can't even be calculated. No one can afford them.

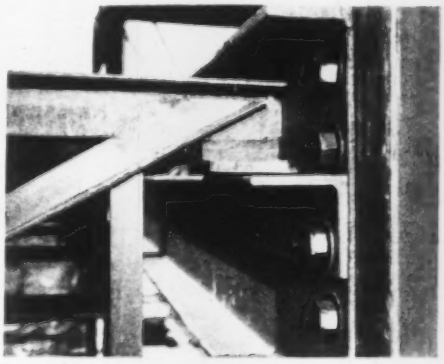
Such was the case with the dilapidated wooden bridge shown on the opposite page, built to handle flood stage on a small stream. Most of the time it served no function at all. But all of the time it was a dangerous eyesore, requiring year-round upkeep.

Today this problem is handled by a Republic Sectional Plate Pipe-Arch bridge, as handsome as it is maintenance-free. To span the original distance of 300 feet, only sixteen parallel lines of Republic Sectional Plate Pipe-Arch were used. Each has a span of 13' 4" and a rise of 8' 5". No more maintenance is needed than on any section of normal highway. The pipe-arch bridge, itself, requires none. It won't crack, crumble or spall under impact, vibration or shifting fill

Everyone gains when expensive, outdated bridges are replaced with modern, safe spans. That's why it will pay you to get full information on the economy Republic Drainage Products provide in bridge construction, as well as all other types of water runoff applications. Contact the Drainage Products Manufacturer nearest you. Or mail the coupon, today.

MODERN STREAM ENCLOSURE shown here demonstrates versatility of Republic's drainage product line. Complete line includes Corrugated Metal Pipe, Perforated Corrugated Metal Pipe, Sectional Plate Pipe, Corrugated Metal Pipe-Arch, Sectional Plate Pipe-Arch, and Sectional Plate Arch.

UP-TO-DATE CONSTRUCTION of bridges and buildings makes ever increasing use of high-strength bolts. Major advantages are time-savings, greater strength, increased safety, and reduced noise. Send coupon for information on Republic High-Strength Bolts.



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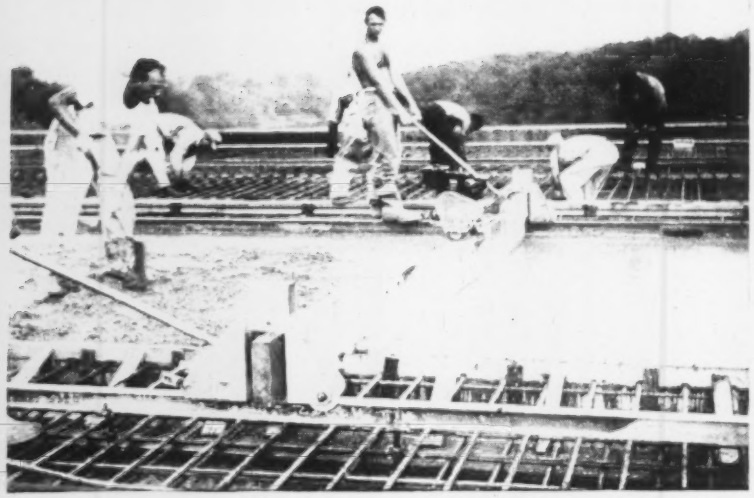
NEW STOW SCREED
on display at road show



For many years contractors have had a real problem getting a good concrete pavement on bridge decks. Thanks to a new vibrating screed, which vibrates the concrete as it is being finished, contractors can now place much stiffer concrete which means much better slabs. Thus inferior decks produced by hand finishing no longer need be tolerated.

If you have not seen a Stow screed on a job, be sure to see the movies of the Stow vibrating screed in action, at the Road Show. These movies show the Stow screed finishing bridge decks on the Massachusetts Turnpike and on short sections of highways.

The Stow vibrating screed consists of a vibrating unit driven by a 2-1/2 HP engine and a beam with a pair of end roller assemblies and handles at each end. Vibration is transmitted through the length of the beam directly to the concrete. There is no transverse movement of the beam. The Stow screed is merely drawn directly forward with the end rollers riding on the forms or on rails. The screed vibrates the concrete and at the same time strikes it off leaving a smooth, true-to-grade surface.

Not only does the Stow screed produce a better riding surface, but it saves the contractor money by cutting production time. Experience has shown that with the same crew, a contractor, even on bridge decks, can often cut his production time almost in half.

The Stow screed shown above has a special underslung construction allowing the end rollers to ride on rails mounted above the surface of the concrete.

Stow screeds are also used to finish short sections of highways and concrete floors. If you would like to learn more about Stow vibrating screeds, stop at our booth—No. 339—at the Road Show. Also on display will be Stow's vibrators, concrete grinders, and Roto-Trowels.

If you are not attending the show, write for Cat. 560 and information on Stow Screeds.

STOW

STOW MANUFACTURE CO., 19 Shear St., Binghamton, N. Y.

Books

Timber Handbook

TIMBER DESIGN AND CONSTRUCTION HANDBOOK—By Timber Engineering Co. 622 pp. F. W. Dodge Corp., New York, N. Y. $12.75.

This reference work is organized into three main sections. Section I covers fundamental properties of wood—types, grades and preservative treatments. Section II deals with design details, but also includes a small amount of information on fabrication and erection. Section III presents specifications and tabular data, such as capacity of connections and members, bending moment diagrams and glossary of terms.

The book was prepared by Timber Engineering Co., engineering and research affiliate of the National Lumber Manufacturers Co. Twenty-five timber specialists contributed to the work. Timber Engineering Co., 1319 18th St., N.W., Washington, D. C.

Miscellaneous Notes

• **Employment of scientists**—A survey of employment and other characteristics of American scientists has been made by the National Science Foundation. The compiled report is based on replies of more than 94,000 scientists in different scientific fields. The report —Employment Profile of Scientists in the National Register of Scientific and Technical Personnel, 1954-1955—contains the most recent data available on so large a number of scientists.

One aspect included in the report is the distribution of the scientists—one-half are in industry, one-third are employed by educational institutions, the remainder hold jobs with the government. Also, research, development or field exploration is the primary function of half the scientists; management or administration of 18%, and teaching of 16%.

Median salaries coupled to education levels also are given, but this section is not too strong since some of the groups did not report salary. The 8-page bulletin may be obtained by writing to National Science Foundation, Washington 25, D. C.

WORLD CONFERENCE ON EARTHQUAKE ENGINEERING—Proceedings of conference sponsored by Earthquake Engineering Research Institute and University of California held June 12-16, 1956 (ENR July 26, 1956, p 32). 529 pp. May be ordered directly from Karl V. Steinbrugge, Secretary, The Earthquake Engineering Research Institute, Room 1039, Merchants Exchange Bldg., 465 California St., San Francisco 4, Calif. $8.50.

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For Sales and Service see "Radio Communication Equipment" in your Yellow Pages. Or, write: *General Electric Company, Communications Equipment, Section C2717.24, Electronics Park, Syracuse, N. Y.* In Canada, write: C.G.E. Electronics, 181 Lansdowne Avenue, Toronto.

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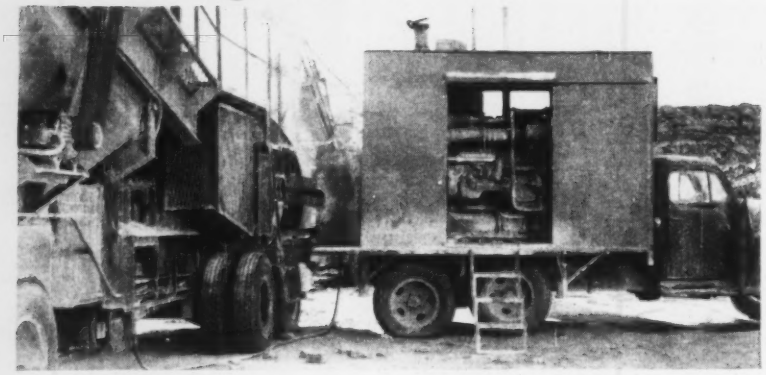
WAUKESHA Diesels



● These two portable crushing plants, shown operating near Appleton, Wis., are *powered for production*—with *Waukesha Diesels*. Both plants and their crushers were built by Highway Machinery Corp., Waukesha, Wis. In the primary-crushing plant (above, right) the 3′ x 10′ Simplicity Vibrating Scalper-Feeder and conveyor are driven by the current from a Waukesha-powered 100 KW generator in the truck (above, center). The 25 x 36 Jaw Crusher is powered by a 148-DKU Waukesha Diesel. This 6-cyl., 5½ x 6-in., 779 cu. in., 155 max. hp unit handles every load demand eagerly and easily, with power to spare. The secondary-crushing plant (above, left) consists of a Double Jaw Crusher with twin 8 x 36 units, a 25″ x 40″ Roll Crusher, a 5′ x 12′ Simplicity double deck Sizing Screen, and conveyors. Its separate, mobile Waukesha power plant is mounted in the truck (shown below) with a 100 KW Generator. This Waukesha NKDBSU Turbo-Supercharged Diesel—6-cyl., 7 x 8¼-in., 1905 cu. in., with counterbalanced crankshaft—drives the two crushers, and powers the generator which supplies current for all incidental equipment. A rugged, compact engine with lively acceleration, clean burning, prompt starting, great overall economy *and* smooth extra power up to 368 hp. Get Bulletins 1634, 1414.

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Pamphlets

METALLIZING — BIBLIOGRAPHY—American Welding Society, 33 W. 39th St., New York 18. $1.50.

EFFECTS OF MINERAL ADDITIVES ON THE DURABILITY OF COATING—GRADE ROOFING ASPHALTS—Building Materials and Structures Report 147. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 20¢.

SAFE PRACTICE FOR HOSPITAL OPERATING ROOMS—NFPA No. 56. National Fire Protection Association, 60 Batterymarch St., Boston 10. 25¢.

PRESSURES DEVELOPED BY RAPID COMBUSTION—Factory Mutual Engineering Division, 1151 Boston-Providence Turnpike, Norwood, Mass. $1.00.

RECOMMENDED PRACTICE FOR WINTER CONCRETING—American Concrete Institute, 18263 W. McNichols Rd., Detroit 19. To ACI members 50¢; nonmembers 75¢.

STANDARDS FOR THE INSTALLATION OF SPRINKLER SYSTEMS—NFPA No. 13. National Fire Protection Assoc., 60 Batterymarch St., Boston 10, Mass. $1.00.

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SELECTED BIBLIOGRAPHY OF BUILDING CONSTRUCTION AND MAINTENANCE—BUILDING MATERIALS AND STRUCTURE REPORT 140. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 30¢.

SNOW HYDROLOGY—Summary Report of the Snow Investigations, Corps of Engineers, North Pacific Division, Portland, Oregon.

DESIGN—A handbook of case studies on standards for successful home planning, United States Savings and Loan League, 221 N. LaSalle St., Chicago 1, Ill.

NATIONAL ELECTRICAL CODE, 1956—480 pp. National Fire Protection Assoc., 60 Batterymarch St., Boston 10, Mass. $1.00.

CULVERT FLOW CHARACTERISTICS—Bulletin 126. Highway Research Board, 2101 Constitution, Washington, D. C. 60¢.

NIGHT VISIBILITY 1955—Bulletin 127. Highway Research Board, 2101 Constitution, Washington, D. C. $1.20.

DISTRIBUTION OF AIR WITHIN A ROOM IN YEAR-ROUND AIR CONDITIONING—Part I.—Experiment Station Bulletin No. 445. University of Illinois, Urbana, Ill.

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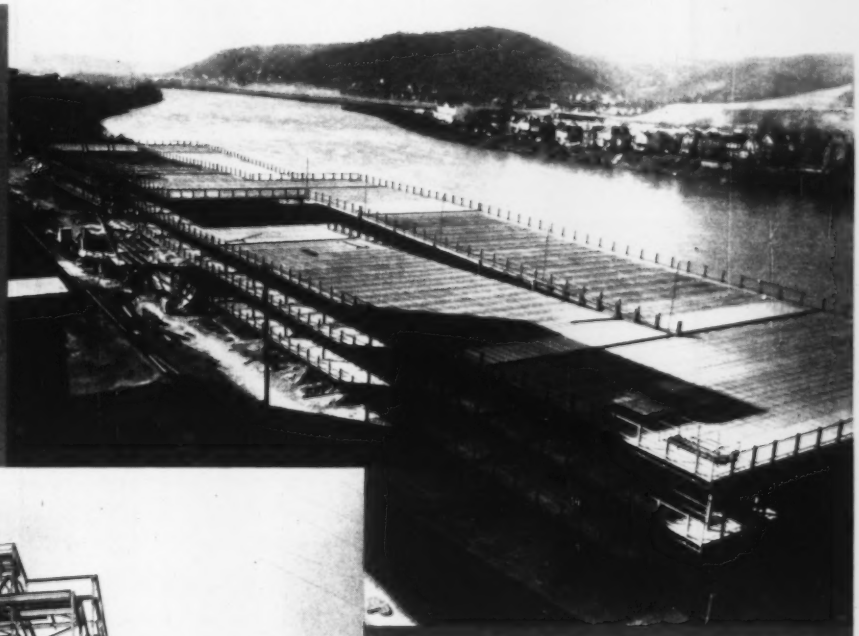

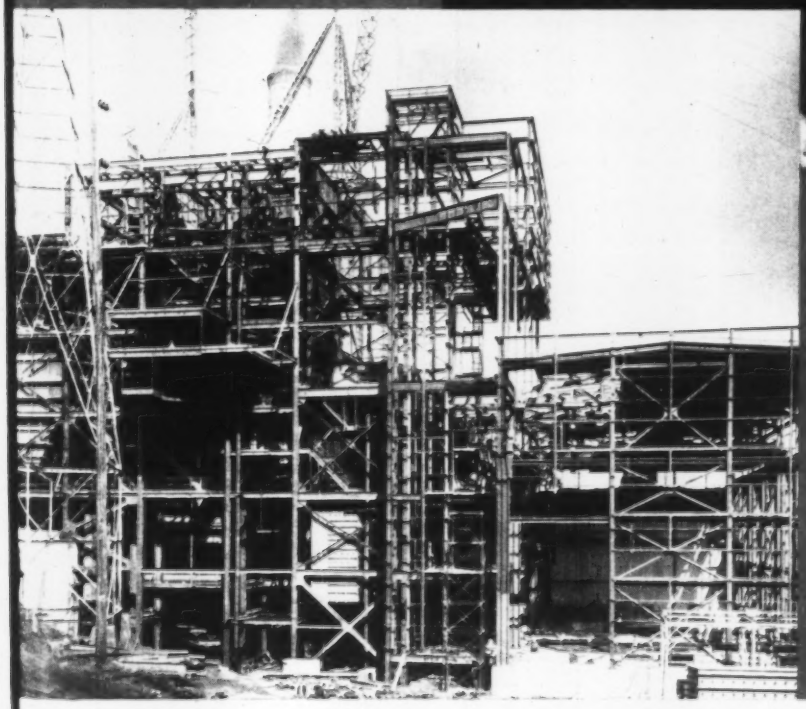

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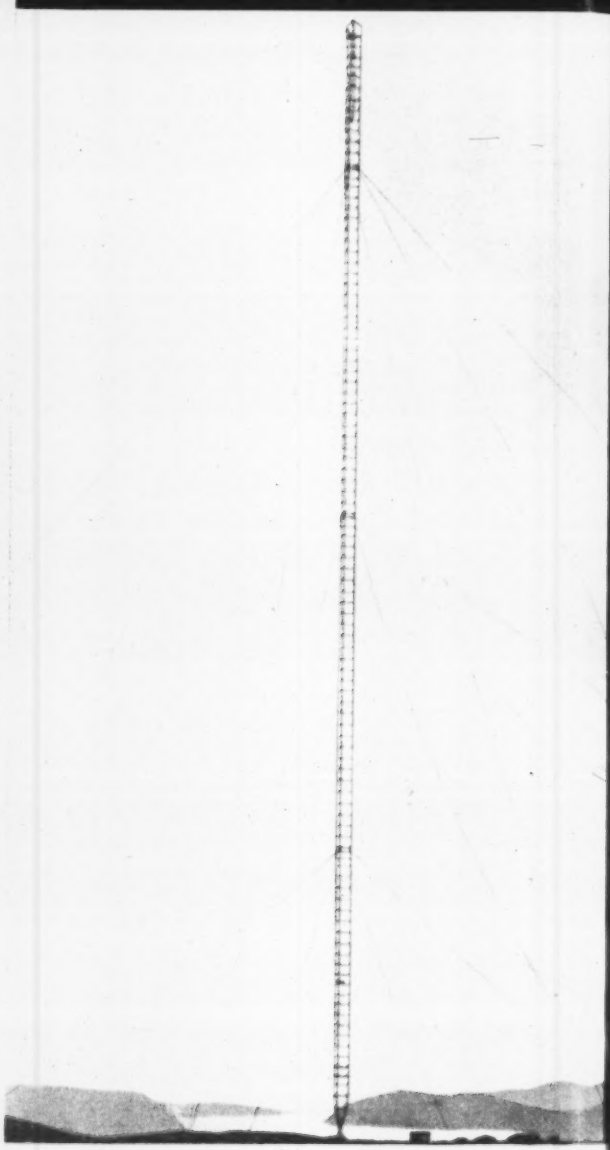
THE TUNNEL: A Liberty Mutual policyholder had a contract to build a twenty-seven mile aqueduct through the Catskill Mountains. The tunnel on this project involved two intermediate shafts, and the outlet portal that had seven headings, in operation twenty-four hours a day, five days a week. To service this job, Liberty Mutual opened an office in a nearby community. On-the-spot experienced Loss Prevention Engineering, claimsmen on the job site and the full cooperation of the contractor, resulted in the return to the contractor of more than $700,000 as retrospective premium savings.

A TOWER..



THE TOWER: One of the toughest jobs in the Thu project was the erection of a 1206-foot tower. Despite ha ardous conditions in Arctic gales, only one minor accid resulted on this intricate but small part of the job. Libe engineers watched over the safety of the thousands of co struction workers on the whole Thule project. The accid record there was 75% better than the U. S. record for co struction companies. Liberty's engineering approach to ac dent prevention and the cooperation of the contractors re duced losses. The final insurance cost for the project wa millions of dollars less than expected.

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New Forming Technique Produces Sawed Joints At Less Cost

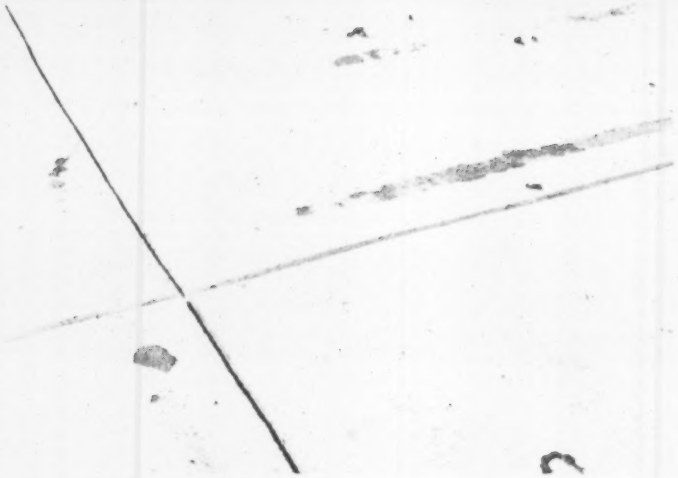
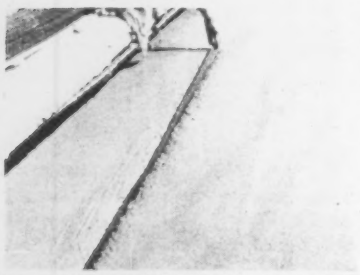


FIGURE 1

...uses KORK-PAK® as dummy joint filler; removes filler after concrete cure by sawing

An interesting new joint forming and sawing technique, in which lengths of KORK-PAK® —a non-extruding expansion joint filler, are used as a dummy joint filler and then sawed out by an inexpensive ⅛" carborundum blade after the concrete has cured, has been developed and used with good results by T. L. James Construction Company on a Mississippi State Highway Project. Location of the Project was on Route 51, south of Jackson, Miss.

Clean, straight ¼" joints (Fig. 1) are produced at a fraction of the cost of sawing ⅛" joints in the ordinary manner with a diamond blade. Joint sawing speed was considerably increased, and the resulting ¼" wide joint was sealed with "Zero-Lastic"®, a single component, cold-applied joint sealing compound manufactured by Servicised Products Corporation, Chicago, who also produce the KORK-PAK material used on the project.



KORK-PAK DUMMY JOINT is embedded in concrete. *Figure 2*

KORK-PAK is a composition of asphalt and granulated cork, formed between two sheets of asphalt saturated paper. It is non-extruding and is readily handled without breakage. It is a general purpose joint filler widely used on highway and turnpike projects. The KORK-PAK material was easily sawed out and did not gum up the blade, as did other types of asphalt and hard-board joints.

HAND FINISHING over embedded joint produces smooth surface. *Figure 3*

Essentially, the new technique consists of embedding ¼" wide x 2" high lengths of the KORK-PAK in transverse and longitudinal joints at the time the concrete is being placed (Fig. 2). Transverse joints were spaced at 31'4" intervals. The small surface sections of concrete disturbed by insertion of the joint were finished by hand. (Fig. 3).

After the concrete cured, a saw, equipped with a ⅛" carborundum blade quickly and easily removed the top inch of the KORK-PAK (Fig. 4) leaving the other inch undisturbed in the concrete. When desired, the blade can be set to remove all of the dummy joint and seals up to 2" or deeper can be obtained.

AFTER CONCRETE CURES, top 1" of dummy joint is sawed out. *Figure 4*

Using the KORK-PAK dummy joint technique, the contractor reported getting from 2500 to 3000 lineal feet per blade. The ¼" joint obtained was practical to seal and gave the pavement the same riding qualities as one in which the joints were sawed by a diamond blade in the conventional manner.

SEALING JOINT — "Zero-Lastic" Cold-applied material is pumped into joints from container. *Figure 5*

After cleaning the sawed joints, the contractor applied Servicised "Zero-Lastic" Joint Sealing compound (Fig. 5) in the usual manner.

More information and specific details on the material and equipment used on this project are available from Servicised Products Corporation. Write for the Servicised Catalog which contains valuable data and complete details on Servicised Asphalt, Cork and Rubber composition products for the construction industry.

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Unit Prices

Pennsylvania Specifies Minimum Equipment for Road

This ten miles of highway includes a dozen kinds of road construction. The largest section, almost six miles, will be divided, 24-ft strips of 10-in. reinforced concrete pavement separated by an earth median of 20 ft and variable width. Pavement ranging from 52 ft to 24 ft on another strip, bituminous surface, ten bridges, ramps, marginal roads, intersections and landscaping all are priced at $5,694,425. This work for Pennsylvania Department of Highways is in York County, in three townships, the city of New York and Loganville Borough.

Bazley Inc.'s low bid on excavation took the contract. His total is 1.5% below the second and 5% below the fifth high of nine bids.

One I-beam bridge and nine reinforced concrete culverts are on the divided highway section. On other stretches are five I-beam, two plate girder and two reinforced concrete bridges with an overall length of 1,183 ft.

The state requires that the contractor demonstrate that he will use sufficient equipment. These are the minimum requirements set: three 3-cu yd power cranes, 12 x 24-cu yd power shovels, 12 x 15-cu yd power scrapers, 24 x 10-ton power rollers, one 8-ton to 10-ton tandem power roller and two 3-ton to 6-ton power rollers; one dual-drum paving mixer, 13 construction mixers, two pile driving outfits and one mechanical bituminous spreader and paver, one pneumatic drill, one pneumatic riviter, one electric welding outfit and sufficient stone spreaders, compressors, pick-hammers and pumps.

Minimum wage rates include $2.15 to $2.80 for equipment operators, $1.75 for pipe layers and $1.60 for seeders and planters and for asphalt workers.

Bidders are:

1C J. Robert Bazley Inc., Pottsville, Pa.	$5,694,425
2 Central Pa. Quarry, Stripping & Const. Co., Hazelton, Pa.; Reed & Kuhn Inc., Elysburg, Pa.; H. R. Miller Co., Inc., Lancaster, Pa.	5,780,332
3 Nello L. Teer Co., Durham, N. C.	5,993,089

Bids: 11 30 56 Items	Unit	Quantity	Unit Prices 1C	2
Clear & grub	ls	job	$35,000	$35,000
Exc, class 1	cy	2,431,659	0.60	0.78
class 2	cy	30,348	2.55	3.50
class 3	cy	10,248	5.00	5.00
Subgrade	cy	7,968	0.25	0.30
special	cy	274,845	0.55	0.60
Shoulders	lf	2,492	0.50	0.45
Base crse, cr agg, type A, 6"	sy	2,182	1.35	1.25
8"	sy	5,794	1.75	1.50
10"	sy	17,579	2.10	1.80
Shoulders, stabilized	lf	43,005	2.25	1.50
Agg, coarse, 2B	cy	1,583	5.00	5.00
Surf matl, selected	cy	770	5.00	3.50
Base crse, pt 6C, ty A, 8"	sy	1,256	7.00	6.00
10"	sy	45	9.50	7.00

Bids: 11 30 56 Items	Unit	Quantity	Unit Prices 1C	2
Pvmt, pl CC, 4"	sy	77	5.65	6.00
RCC, 10"	sy	188,377	5.75	5.38
Surf crse, b.t, ID-2, 2"	sy	23,393	1.70	1.65
1"	sy	2,188	1.20	1.15
Concrete, c A	cy	9,048	51.00	51.50
cl AA	cy	5	150.00	200.00
cl B	cy	8,755	38.00	38.50
Reinforcement bars	lb	2,202,046	0.12	0.12
Str steel fabric	lb	3,620,754	0.187	0.1862
Railing, parapet, alum	lf	2,879	7.00	11.00
Bkfl, stone, for struct	cy	100	7.00	7.00
for misc drainage	cy	17	7.00	5.00
Test piles, stl hm, 12BP53				
2 @ 26 & 2 @ 32	ls	job	1,500	1,800
2 @ 26 & 4 @ 38	ls	job	2,000	2,400
2 @ 68	ls	job	1,500	1,000
4 @ 32	ls	job	1,500	1,800
1 @ 38 & 3 @ 44	ls	job	1,800	2,000
8 @ 56	ls	job	4,000	3,000
Piles, stl beam, 12BP53				
14	lf	1,606	5.70	5.75
20	lf	1,960	5.60	5.75
26	lf	2,184	5.50	5.70
32	lf	1,944	5.50	5.70
38	lf	3,344	5.50	5.50
44	lf	1,232	5.50	5.50
50	lf	950	5.50	5.50
56	lf	784	5.50	5.60
62	lf	434	5.60	5.60
68	lf	544	5.70	5.60
Brs superstruct, remove	ls	job	5,000	2,500
Stone wall, plain stone	cy	25	40.00	50.00
Conc, cl B, for spillway	cy	17	45.00	50.00
Pvmt, stream-bed, conc, cl B, 6"	cy	283	45.00	45.00
Manholes, type A	ea	2	350.00	500.00
Inlets, 4'	ea	108	350.00	500.00
special	ea	18	350.00	325.00
special, modif	ea	2	350.00	350.00
6'	ea	1	800.00	800.00
type H	ea	130	350.00	500.00
type J	ea	7	350.00	500.00
CMP, 18"	lf	576	4.35	4.25
24"	lf	44	6.00	6.00
asph ctd, 15"	lf	1,624	5.50	5.25
18"	lf	452	5.00	5.20
42", 8-ga	lf	156	23.00	20.00
fully asph ctd, 15"	lf	430	5.20	5.00
18"	lf	262	5.75	5.50
24"	lf	36	10.00	9.00
54"	lf	154	26.00	18.50
fully ctd, elongated, 36", 10-ga	lf	182	20.00	15.00
8-ga	lf	232	21.00	17.00
48", 10-ga	lf	342	23.00	20.00
End sections, CM, asph ct, 15"	ea	9	23.00	21.00
RCCP, 15"	lf	2,844	3.75	4.00
18"	lf	4,858	4.70	5.00
24"	lf	690	6.60	7.00
30"	lf	748	8.60	9.00
36"	lf	386	12.00	12.00
42"	lf	136	15.00	14.00
24", extr strength	lf	162	7.25	9.00
30", extr strength	lf	372	10.00	10.00
RCCP, open jt, or VCP, extra strength, open jt, or CMP, asph ctd, perf, 18"	lf	6,634	4.70	5.00
24"	lf	3,686	6.60	7.00
30"	lf	1,146	8.60	8.00
36"	lf	710	12.00	12.00
RCCP or VCP, ES, or CMP, asph ctd, 18"	lf	32	7.10	5.00
Pipe, 6", undrdr, bkfl type II	lf	425	1.35	1.50
fndn undrdr, type A, bkfl type I	lf	15,629	1.35	1.50
bkfl type II	lf	5,736	1.35	1.50
type B, bkfl type I	lf	4,928	1.35	1.50
bkfl type II	lf	3,390	1.35	1.50
Pipe, 6", undrdr outlets	lf	276	1.20	1.25
Curb gutter, CC, type A	sy	240	10.00	8.00
type B	sy	304	11.00	8.50
Curb, white reflect, conc type A	lf	662	2.50	2.75
type B	lf	2,960	2.50	2.70
Curb, CC, type A	lf	27	3.00	4.00
type B	lf	1,670	3.00	3.00
Sidewalks, CC	sy	1,495	5.00	5.00
Gd fence, type 1-C	lf	33,248	1.50	1.50
Gd posts	ea	42	12.00	10.00
End anchorages, type C	ea	78	50.00	50.00
Barricade, perm, type A	lf	130	8.00	8.00
Gd fence connections	ea	36	50.00	75.00
Seed & soil supplements, slope mixture	sy	312,328	0.04	0.05
berm mixture	sy	144,615	0.04	0.05
crown vetch	sy	63,359	0.04	0.05
Mulch, hay	sy	415,267	0.04	0.04
straw	sy	105,035	0.05	0.04
Vines, 2 year, No. 1	ea	3,800	0.55	0.60
Hall's Honeysuckle	ea	40,900	0.65	0.45
Seedlings, 1-0	ea	7,950	0.45	0.25
Shrubs, 18-24"	ea	8,500	0.80	0.65

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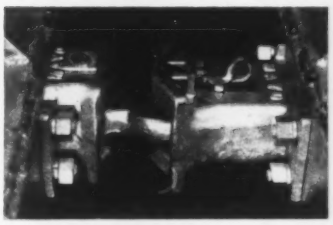

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Atlanta	†	$83 00	$88 00	$77 50	$76 00	$79 50	$83 00	$81 00		
Baltimore	*	92 00	96 00	96 00	98 00	98 00	102 00	114 00		
Birmingham	†	86 00	88 00	81 00	88 00	91 00	96 00	111 00		
Boston	†	104 00*f*	104 00*f*	110 00*f*	110 00*f*	110 00*f*	118 00*f*			
Chicago	**	94 00	97 00	91 00	105 00	113 00	114 00	109 00		
Cincinnati	*	101 25	102 50	90 00	98 25	103 00	111 50	119 50		
Cleveland	**	91 00	92 00	99 00	97 00	97 00	97 00			
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Detroit	‡	116 50	119 50	114 00	117 00	122 00	127 00			
Kansas City	*	120 00	125 00	120 00	125 00	130 00	135 00			
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Montreal	gh	92 00	102 00	92 00	92 00	110 00	128 00			
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Detroit	130 00			
Kansas City				
Los Angeles				
Minneapolis				
Montreal	123 00	123 00		
New Orleans	156 00	154 00		
New York	240 265	240 265		
Philadelphia	214 224	214 224		
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† F.o.b. mill. * F.o.b. city, CL, out of yard. ** F.o.b. city, CL, direct mill shipment. ‡ Deliv. to contr. CL. 1. Retail, LCL, at yard. # Retail, LCL, deliv. 2. Deliv. truck lots. 3. asd., truckload lots, 5/8 M/tbm

LUMBER: Bold Face Type, Southern Pine. Italics, Douglas Fir. *a Spruce. *b Tax exempt. *c 8M lots. *d 8, 10, & 12 ft. lengths. *e 8 to 18 ft. lengths. *f Hemlock *g No. 1 common. *j 8ft. lengths. *k No. 3 common. *n #3. A Incl rail rate from North west mills to San Francisco are $11.50 to $18.00 per M ft. bm. From Northern Calif. mills $9.00 by rail, $9.50 by truck. All rates for surfaced stock. For rough, add $3.00 to above figures.

PLYWOOD: Interior Fir Plywood, 4' by 8' panels, 3-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $155.00; on ¾", $173.00. Exterior ¼", $163.00, ¾", $183.00. For other centers add rail freight increment from table on proper size. Oiling and edge sealing charges included. *a Lower rate by water shipment. *b 50,000 lb. minimum.

GLASS, EXPLOSIVES, CHEMICALS

WINDOW GLASS

Discounts from jobbers list, Feb. 1, 1950a

	Single or Double Strength A quality	Single or Double Strength B quality
Atlanta	77%c	78%e
Baltimore	74%d	76%d
Birmingham	82%	83%
Boston	72–10%f	72–10%
Chicago	72%	72%
Cincinnati	74%	74%
Cleveland	74–2–10%	74–2–10%
Dallas	75%	75%
Denver	73%	73%
Detroit	74–10–10%	74–10–10%
Kansas City	76–10%	76–10%
Los Angeles	70%	70%
Minneapolis	71–10%	71–10%
Montreal	40–10–5%bc	40–10–5%b
New Orleans	75%	76%
New York	79%	79%
Philadelphia	74%	76%
Pittsburgh	73%	73%
St. Louis	76–10%	76–10%
San Francisco	60%	68%
Seattle	67%	70%

Glass: *a Jobbers' list price per box, 14 x 20, ss, $42.75 for A quality, $37.50 for B quality; 14 x 20, ds, $60.00 for A quality, $52.75 for B quality. *b Discount from list, Apr. 1951; sales tax included, but 6% tax exemption not allowable for. *c 77% for single strength *d Discount 8/15/52. *e 77% for double strength

EXPLOSIVES

Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*

Atlanta	$0.2540
Baltimore	.2540
Birmingham	.1990
Boston	.2540
Chicago	.2540
Cincinnati	.2540
Cleveland	.2940
Dallas	.2615
Denver	.2590
Detroit	.2540
Kansas City	.2590
Los Angeles	.2565
Minneapolis	.2590
Montreal	22.05h
New Orleans	.2590
New York	.2442*g*
Philadelphia	.2540
Pittsburgh	.2540
St. Louis	.2590
San Francisco	2540
Seattle	2565

Price of 60% Ammonia Gelatin is $0.15 per lb. higher than 40% in U. S., $1.75 per 100 lbs. higher in Canada.

Explosives: *Cartridges of 1¼", 1½", 1¾", 2", 2¼", 2½", 3" diameters. Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. *g In borough of Kings, Queens, and Richmond and in Manhattan south of Canal St., add delivery charge of $20.00 per trip. *h F.o.b Beloeil (near Montreal), per 100 lb. forcite, 40% Forcite 60%, $23.80

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C.L. 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.1990	$0.2340	$0.2540
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.2040	.2390	.2590
Rocky Mtn. States	.2040	.2390	.2590
Pacific N. W. States	.2015	.2365	.2565
Pacific S. W. States	.1990	.2340	.2540

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark off, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail Pine*	By Rail Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.51	....
12-in.—2-ft. from butt	6-in.	50 to 59-ft.	.54	....
12-in.—2-ft. from butt	6-in.	60 to 69-ft.	.58	....
12-in.—2-ft. from butt	6-in.	90 to 100-ft.	....	....
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	....
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.50/.68	....
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.78/.88	.93
14-in.—2-ft. from butt	5-in.	80 to 85-ft.	.83/.93	.94
14-in.—2-ft. from butt	5-in.	85 to 89-ft.	....	1.00
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	1.02

* Pine piling over 80-ft. available only in limited quantities

RAILWAY TIES

Prices f.o.b. per tie for carload lots:

		8" x 8" x 8' Untr.	8" x 8" x 8' Tr.	7" x 8" x 8'6" Untr.	7" x 8" x 8'6" Tr.
Birmingham*	Hardwood, Grade 3	$1.70	$2.55	Gr. 5 $2.25	$3.33
	Grade 2	1.50	2.35	* 4 2.10	3.18
	Grade 1	1.15	2.00	* 3a 1.70	2.78
Chicago	Red Oak		4.00a		4.60a
New York	S. L. Sap Pine	2.00*d*	4.00*d*	3.00*g*	6.00*g*
	Mixed Oak	2.50*d*	4.50*d*	3.50*g*	6.50*g*
Philadelphia	Red Oak	2.95/3.15	4.50/4.70	3.60/3.80	5.50/5.75
St. Louis	White Oak	2.65		2.95	
	Red Oak	2.55	3.25a	2.80	3.60a
	Sap Pine or Cypress		3.15a		3.55a
San Francisco	Douglas Fir	2.03*ef*	2.96*ef*	2.84*hef*	4.31*ef*

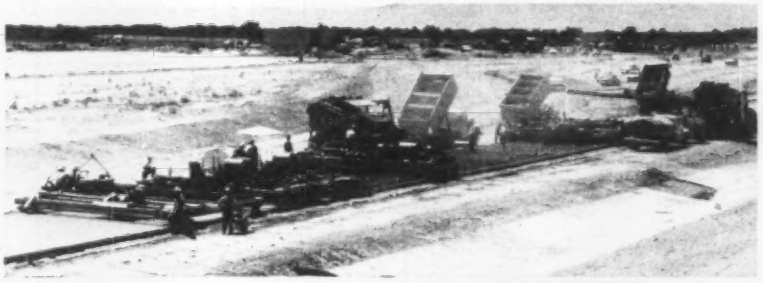
Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cel *d* 6 x 8 x 8'6" *e* Green. *f* f.o.b. cars. *g* 7 x 9 x 8'6" * Add 75¢/tie freight charge to Birmingham.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb	$5.00
Chlorine cylinders, liquid, per lb. f.o.b. works	1.3
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, f.o.b. works, ton	29.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	2.25
Soda ash, 58%, in paper bags, per 100 lb. dense	1.75
Sulphate of aluminum, commercial, in 100-lb. bags f.o.b. works	1.85
Sulphate of copper, in bags, 99% per 100 lb. f.o.b. works	14.50

KANSAS TURNPIKE



Sheffield Welded Wire Fabric Provides "Backbone of Steel" for 10" Slab

Spanning the plains 236 miles from Kansas City, Kansas, to the Oklahoma line, the new Kansas Turnpike reduces by some 26 miles the former 223-mile travel distance between Kansas City and Wichita. Cuts driving time at least one hour and 35 minutes.

Engineered For Safe Driving. Maximum grade is three per cent and maximum curvature three degrees, with minimum sight distance of 750 feet in rural areas. All grade crossings and stop signs are eliminated.

Right-of-way is approximately 10,000 acres. Roadway is two 24-foot paved traffic strips in each direction, with additional surfaced shoulders. All bridges are dual, with 20-foot separation.

Sheffield Welded Wire Fabric and steel reinforcing bars were used for more than 1,688,000 square yards of concrete paving and bridges. Reinforced with Sheffield welded wire fabric the concrete slab will serve better and save maintenance money because of its backbone of Sheffield steel.

Tests and experience (dating back to the first section of the Pennsylvania Turnpike, completed in 1940) prove that steel reinforcement in concrete paving distributes the load evenly in all directions throughout the slab, reduces number and length of cracks, and holds cracks tightly together for greatest resistance to spalling and breaking.

Whether you need the extra strength of steel for a home driveway or a super highway, it will pay you to use Sheffield Welded Wire Fabric. Get all the facts from your nearest Sheffield sales office.

SHEFFIELD

ARMCO®

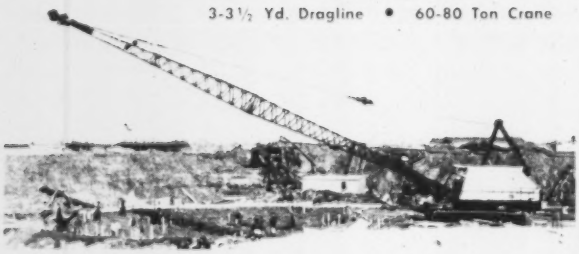
Welded Wire FABRIC

SHEFFIELD DIVISION ARMCO STEEL CORPORATION SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

Big 5½-yd. Manitowoc Model 4500 has single diesel power package—no complicated electric motors. You get the big capacity needed for modern construction jobs, plus . . . flexible, small-machine maneuverability.

Right down the line—Manitowoc . . .

MODEL 3900
3-3½ Yd. Dragline • 60-80 Ton Crane



MODEL 2800
1½ Yd. Dragline • 40 Ton Crane

MODEL 3500
2½ Yd. Shovel and Dragline • 60-Ton Crane

Lower Bids...More Profit With MANITOWOC

Now is the time to think of new excavating equipment to handle your 1957 jobs. Your competition will be fighting every step of the way for the construction dollar, so you'll want a rig that can give you all the features you need to be low bidder . . . at a profit.

Manitowoc offers more power when the going is rough, greater cycle speed for more yardage, and longer machine life from every unit to keep maintenance costs way down. You'll find your only real competitor is another Manitowoc owner! Capacities range from the fast, rugged 1-yd. Model 1600 to the big, powerful 5½-yd. Model 4500 — a full line to let you meet all job requirements.

You get more bite at the dipper with any Manitowoc because of an exceptionally efficient, simple upper works design. An exclusive sliding pinion arrangement provides fast, smooth operating speeds with direct power flow — eliminates unnecessary power-robbing gears and pinions. Sturdy construction throughout guarantees years of extra service with less downtime.

Massive carbodies and large, wide crawlers assure safe stability for any job. A simple, rugged travel drive and positive steering take your Manitowoc with fast, sure mobility over the roughest terrain.

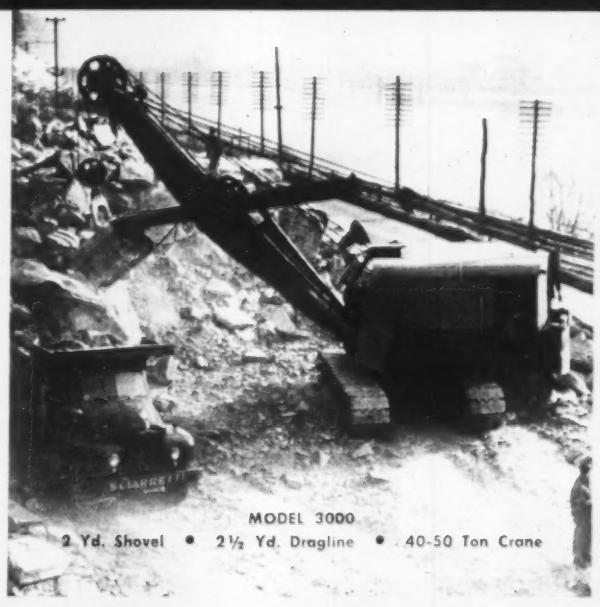
Optional features like air controls, torque converter power and elevated cabs increase operator efficiency and comfort — help to finish work ahead of schedule. And all Manitowocs are easily convertible for a variety of assignments.

Find out why more and more successful contractors are turning to Manitowoc for additional profit per job. Your helpful Manitowoc distributor has complete specifications and details on the entire line of quality Manitowoc excavators and cranes. See him now to get the jump on competition for 1957!

Manitowoc Engineering Corp., Manitowoc, Wisconsin.

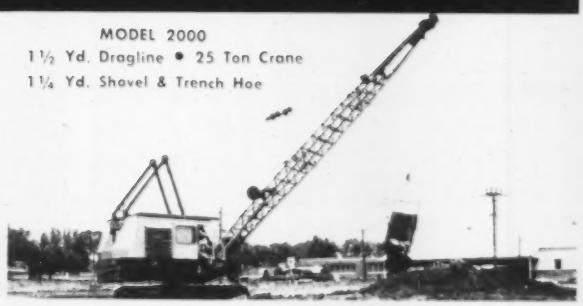
MANITOWOC
SHOVELS 1-5½ YD. Speed Crane CRANES 20-100 TON

means more machine for your dollar!



MODEL 3000
2 Yd. Shovel • 2½ Yd. Dragline • 40-50 Ton Crane

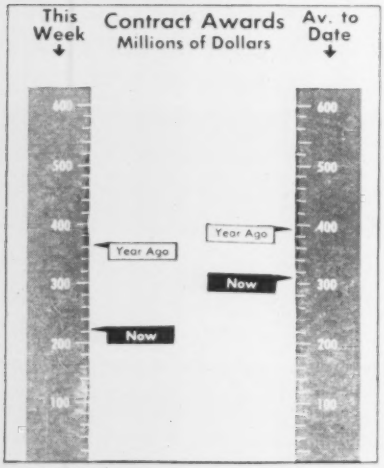
MODEL 2000
1½ Yd. Dragline • 25 Ton Crane
1¼ Yd. Shovel & Trench Hoe



MODEL 1600
1 Yd. Shovel & Trench Hoe • 1¼ Yd. Dragline • 20 Ton Crane

Construction Scoreboard

Activity this Week



4-Day week.

AMOUNT OF CONTRACTS LET

By Ownership	This Week*	1957	Cum. 4 wks Chge %
	millions		
Federal	$20.4	$193.7†	−0.5
State and Municipal	120.4	513.1†	−3
Total Public	140.8	706.8	−3
Total Private	81.3	550.1	−37
U. S. Total	$222.1*	$1,256.9	−21
By Type of Work			
Waterworks	$5.3	$11.0	−51
Sewerage	7.3	13.9	−61
Bridges	5.5	11.6	+6
Highways	56.9	206.3	+11
Earthwork, Waterways	5.9	116.5	+58
Buildings:			
Public, Excl. Housg.	33.1	170.4	−12
Public Housing	6.1	21.5	−38
Private Housing	10.9	243.5	−35
Commercial	16.6	60.1	−70
Industrial	21.1	215.6	−15
Unclassified	22.5	122.0	−12
U. S. Total	$222.1*	$1,256.9	−21

* 4-Day week. † Previous week revised to: Federal, $55.5 mil.; State & Municipal, $123.6 mil.

NOTE: Minimum size projects included are: Waterworks and waterways, $44,000; other public works, $73,000; industrial buildings, $93,000; other buildings, $344,000.

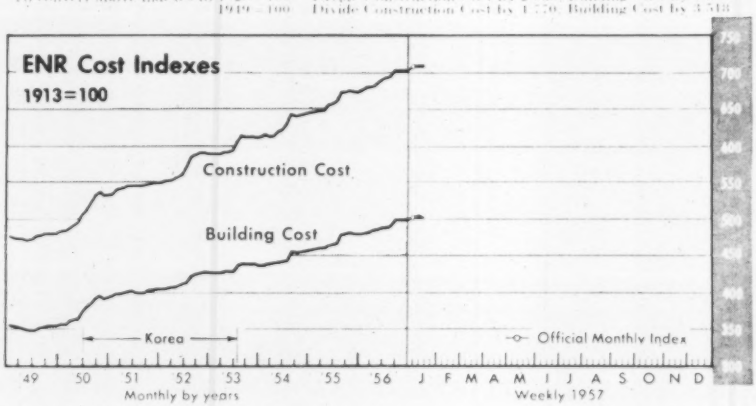
NEW CAPITAL FOR CONSTRUCTION

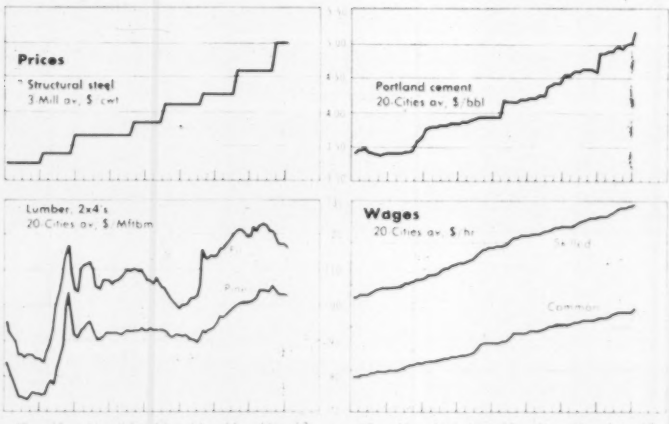
	Week of Jan. 17	1957	Cum. 3 wks Chge '56-'57 %
	millions		
Corporate Securities	$128.3	$428.7	+500
State and Municipal:			
All Except Housing	102.4	136.1	−21
Housing	...	...	...
Federal Loans	1.7	8.6	+15
Federal Aid	...	...	...
Total Nonfederal	$282.4	$573.5	+123
Federal Appropriations:			
In U. S.	...	...	...
Outside U. S.	...	...	...
Total New Capital	$282.4	$573.5	+123

Cost Indexes as of Now

ENR INDEXES, 1913 = 100, 20-cities' average	Week of Jan. 17 1956	% Change from Dec. 20 1956	% Change from Jan. 19 1956
Construction Cost	708.80	+0.5	+4.3
Building Cost	502.16	+0.5	+4.1

To convert above indexes to 1926 = 100: Divide Construction Cost by 2.050; Building Cost by 1.850.
1949 = 100: Divide Construction Cost by 1.770; Building Cost by 3.548.





ENR COST INDEXES IN 22 CITIES, 1913 = 100

City	Construction Cost Jan. 1957	Construction Cost Percent Change Month	Construction Cost Percent Change Year	Building Cost Jan. 1957	Building Cost Percent Change Month	Building Cost Percent Change Year
Atlanta	523	+0.2	+5.1	442	+0.3	+4.8
Baltimore	642	+6.7	+8.4	499	+0.05	+5.4
Birmingham	551	+0.2	+3.4	456	+0.2	+2.8
Boston	749	+0.2	+5.5	511	+0.3	+4.8
Chicago	790	0	+3.3	506	0	+3.4
Cincinnati	711	−0.6	+5.5	486	−0.9	+3.7
Cleveland	820	+0.1	+5.4	509	+0.2	+5.6
Dallas	533	−0.2	+4.5	448	−0.2	+5.1
Denver	696	0	+6.5	522	+0.6	+7.8
Detroit	809	+0.1	+4.4	528	+0.2	+5.2
Kansas City	716	0	+1.8	505	0	+1.6
Los Angeles	731	0	+3.3	491	0	+3.0
Minneapolis	758	+0.2	+5.2	527	+0.2	+4.8
New Orleans	564	0	+3.3	464	0	+3.0
New York	851	+1.0	+4.6	577	+1.4	+4.7
Philadelphia	749	+0.2	+3.8	556	+1.3	+3.7
Pittsburgh	735	+1.0	+5.5	541	+1.5	+6.6
St. Louis	769	+0.2	+1.2	529	+0.7	+3.2
San Francisco	724	+0.3	+5.7	491	+0.9	+5.6
Seattle	740	+2.5	+7.4	451	+0.2	+4.3
U. S.—20 Cities' avg.	708	+0.6	+4.7	502	+0.4	+4.5
Montreal	561	0	+2.0	438	0	+2.6
Toronto	602	+1.1	+10.0	467	+1.9	+7.5

NEW! NEW! NEW!

BURMEISTER

PORTO-PLANT

MAKES ALL OTHER *Portable* BATCHING PLANTS OUT-DATED!

Check These Outstanding Features - -

Simplified Portability • Aggregate bin has hinged, folding sides . . . all basic units may be skid-, wheel-, or trailer-mounted.

Large Capacity • Produces over 100 cu. yds. per hour . . . 115-125 ton, 3 compartment aggregate bin . . . 350 barrel cement bin.

Complete Plant • All electrical wiring, air lines, air compressor, plumbing, water pump and meter permanently installed.

Fully Automatic System • One-man operation . . . electrically controlled . . . interlocked batching.

Easy Erection and Dismantling • All plug-in connections . . . source of water and power is all that's needed . . . no pits to dig.

Low Cost • Initial price . . . installation cost . . . operating expense . . . all unbelievably low.

AND • The PORTO-PLANT can be used for Central Mix as well as batching — with a Burmeister, 1 to 7½ cubic yard Tilt-Up Mixer.

COMPARE

See if you can find anything to compare with the Burmeister PORTO-PLANT. Permanent plant features in the only truly portable, fully automatic, large capacity batching plant in existence anywhere today. The PORTO-PLANT is *complete — NOTHING MORE TO BUY!*

NOW **SEND FOR MORE DETAILS** →

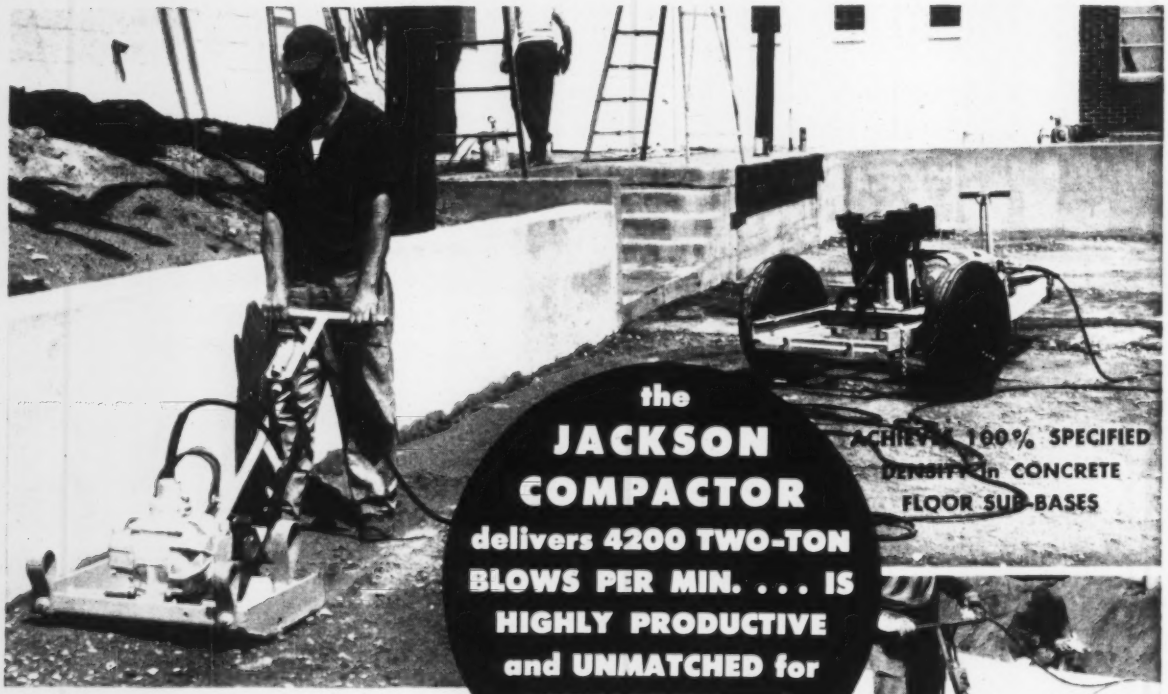
Burmeister

COMPLETE PLANTS FROM A SINGLE SOURCE

See us **in CHICAGO at the ROAD SHOW**

Space No. 847, Donovan Hall
Jan. 28-Feb. 2

L. BURMEISTER COMPANY, Milwaukee 14, Wisconsin



the
JACKSON COMPACTOR
delivers 4200 TWO-TON BLOWS PER MIN. . . . IS HIGHLY PRODUCTIVE and UNMATCHED for VERSATILITY and CONVENIENCE!

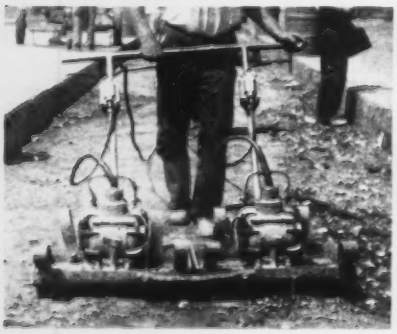
ACHIEVES 100% SPECIFIED DENSITY in CONCRETE FLOOR SUB-BASES

The JACKSON VIBRATORY COMPACTOR, together with a JACKSON auto-trailer-generator unit equipped to quickly pick up and lower the Compactor, is the handiest, most efficient and versatile outfit imaginable for compacting both granular soils and blacktop in an almost unlimited variety of applications. In granular soils 100% specified density is readily achieved in 10" layers at the rate of 1800 sq. ft. per hour. 5" layers of bituminous mixes are also compacted close to maximum density at the same rate of production. And when a twin hookup is used, such as shown below, one man can easily double this production since the machines are self-propelling and need only be guided by the operator. (THE JACKSON IS THE ONLY COMPACTOR WHICH CAN BE USED IN TWIN HOOKUP.) Quickly interchangeable bases of 12" to 26" widths is another feature that adds to the great versatility of the JACKSON COMPACTOR. For consolidating sub-bases of concrete floors, bridge approaches, compacting in trenches, close to abutments, pavement widening sub-bases, patching and widening bituminous pavement and paving blacktop walks and drives this is the greatest money-making outfit you will discover anywhere. See it at your Jackson Distributor. His name and literature gladly sent on request. Write, NOW!

BACKFILL▲▼TRENCHES

JACKSON VIBRATORS INC. LUDINGTON, MICHIGAN

TWIN UNIT DOUBLES PRODUCTION



PAVEMENT PATCHING

PAVING DRIVES and WALKS

Construction Reports

Bids Asked—Low Bidders—Contracts Awarded—First Section—

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York 36, N. Y., ELSIE EAVES, Manager
J. A. MAHONEY, M. WETZEL, L. M. FELIX, M. E. SCIORRA, F. S. DEMBEK, Reports.
J. H. WEBBER, M. R. ROESSLER, E. R. HUBER, Statistics

NEW ENGLAND

HEAVY CONSTRUCTION—BA

▲† Mass., Boston. [illegible] BA [illegible] About 2 [illegible] 5100.56; $5,000,000. Plans [illegible] $60 refund [illegible] Federal Rd., Brighton, engrs. CD 12.7

† Me., Bangor. [illegible] SHOP. BA [illegible] About 2 [illegible] auto. [illegible] exist. [illegible] $2[illegible]

▲† Massachusetts. BA On or About 2-28 [illegible] 5 Eng., 111 E. 16 St., New York 3, N. Y. North Adams Flood Control Project [illegible] North Adams, [illegible] $7-12; $4,000,000. Plans [illegible] $50 [illegible] 21-55.

HEAVY CONSTRUCTION—LB & CA

† Arden Engineering Co., Inc., [illegible] LB $206,246 [illegible] $176,327. [illegible] 1 [illegible] pump [illegible] Fenno [illegible]

▲ MASSACHUSETTS—Commonwealth of Mass., Dpt. P. [illegible] M. DeMatteo Constr. Co., [illegible] A $3,244,181 [illegible]

† Jefferson Constr. Co., [illegible] $637,000 [illegible] $623,000 Lot 2, est. $dd2,200 [illegible] Laboratory Bldg., C. Air Force, Cambridge, [illegible] Mass. CD 12.14

BUILDINGS—LB & CA

Rocheford Constr. Co., Inc., Box [illegible] Framingham, Mass. CA $535,874 [illegible] HAYES-[illegible]

† Carlino Engineering & Constr. Co., 5711 Flood St., Braintree, Mass. LB $512,120, [illegible] $500,000 GUIDED [illegible] PROJECT FACILITIES, Air Force Depot, Nav. [illegible] Spec. 14-[illegible] INTERIOR. CA [illegible] Nov. 8. CD 12.12

L & R Constr. of Medford, Inc., 36 Fort Ave., Medford, Mass. CA $757,575, [illegible] $[illegible] Cross [illegible] Mass. CD 12.14 [illegible]

Walsh Bros., 150 Hampshire St., Cambridge, Mass. CA Approx. $600,000. [illegible] CH. [illegible] WALTHAM, MASS. [illegible] Office, [illegible] WALTHAM, MASS. [illegible] for St. Joseph's R. C. [illegible] Mass. CD 12.19

▲ George A. Fuller Co., 11 Beacon St., Boston, Mass. Approx. $2,500,000. OFFICE, W. [illegible] 171 Washington St., Providence, R. I. [illegible] CD 12.7

MIDDLE ATLANTIC

HEAVY CONSTRUCTION—BA

New York. PARK [illegible] BA 2-7 [illegible] State Parkway, Adm. Bldg., Headquarters [illegible] Long Island Park Bldg., [illegible] Long Island State Park Commission, [illegible] Island, N. Y. CD 12.19

▲† N. Y., Rome. [illegible] S.A.C. BLDG. AREA. BA On or About 2-19 [illegible] S. [illegible] 111 E. 16 St., New York 3, N. Y. [illegible] A.F. Base, [illegible] target intelligence [illegible] Bidders [illegible] and warning bldg., [illegible] and electronic [illegible] purpose [illegible] Spec. [illegible] 1954 [illegible] 57-12; $1,000,000. Plans [illegible] $25 refund [illegible] $5,000,000. Plans [illegible] $25 refund [illegible] CD 12.12

▲† N. Y., Rome. DORMITORIES. BA [illegible] About 2-26 [illegible] S. [illegible] 111 E. 16 St., New York 3, N. Y. [illegible] armed [illegible] and [illegible] for Air Force Base, [illegible] 57-240; $3,000,000. Plans [illegible] $25 refund [illegible] $3,000,000. Plans [illegible] $25 refund [illegible] CD 12.12

HEAVY CONSTRUCTION—LB & CA

▲ NEW YORK—Dpt. P. Wks., The [illegible] Albany, [illegible] State Office Bldg., Albany.

Berlanti Constr. Co., Inc., 15 Pickard Ave., Hicksville, N. Y. CA $3,417,214 [illegible] elimination of grade crossing between the New York Central R.R. and Bethpage and Manville Rds. in Plainedge, [illegible] relocation of 2.41 mi. railroad, [illegible] relocation of passenger station and freight house, 0.15 mi. of [illegible] work on Bethpage [illegible]

▲ J. Rich Steers Co., [illegible] $1,677,000 [illegible]

▲ Charles Vacirca, Inc., [illegible] CA $1,224,420 [illegible] Bldg. No. 248, [illegible] Air Force Base, [illegible] Spec. 14-[illegible] 57-12; $1,000,000. Plans [illegible] $25 refund [illegible] CD 12.12

Nicholas Constr. Co., [illegible] $315,742 [illegible] $446,433. [illegible] Bldg., [illegible] Allegheny Co., [illegible] CD 12.21

▲ MARYLAND

A. H. Smith, [illegible] $924,057 [illegible]

T. Edgar Russell, [illegible] MD. LB $812,127 [illegible]

MARYLAND

M. J. Grove Lime Co., [illegible] CA $825,005 [illegible]

PROJECTS COVERED

By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterways $44,000; other public works $73,000; industrial buildings $93,000; other buildings $344,000. Also Foreign projects of $100,000 and more in size of interest to American contractors.

By Regions & Classes of Construction

(In order of Listing)

BIDS ASKED
LOW BIDDERS
CONTRACTS AWARDED

New England	Middle West
Middle Atlantic	West of Mississippi
South	Far West

PROPOSED WORK

Water Supply	Public Buildings
Sewers, Waste Disposal	Mass Housing
Bridges	Commercial Buildings
Streets & Roads	Industrial Buildings
Earthwork, Waterways	Unclassified

In These Stages

PROPOSED WORK: Before and including appointment of engineers or architects.
BIDS ASKED: BA (new announcements only). For [illegible] see also preceding issues.
SOON LETS CONTRACT: SLC
LOW BIDDERS: LB On jobs below $500,000 in value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.
CONTRACTS AWARDED: CA Except awards to low bidders previously reported in low bidder stage.
CD dates shown are of Construction Daily Issue in which last previous report was published.
OWNERS, ENGINEERS, ARCHITECTS, CONTRACTORS are invited to report their new jobs for listing in these reports when they meet or exceed the size minimums shown above. Address these news releases to J. A. Mahoney, REPORTS, ENGINEERING NEWS-RECORD, 330 W. 42 St., New York 36, N. Y.

Symbols and Abbreviations Include:

†	Federal Government
▲	Project of $1,000,000 or over
ENR	Engineering News-Record
CD	Construction Daily

For additional reports see Construction Daily.

BUILDINGS—LB & CA

▲ John Rolenium, Inc., [illegible] N. Y. CA $1,715,000 [illegible]

▲ Planet Constr. Corp., [illegible] N. Y. CA $1,562,000 [illegible] 12-19, under LB

▲ Laurence J. Rice, Inc., [illegible] N. Y. CA $2,674,000 [illegible] CD 12.19, under LB

▲ Lazere Constr. Corp., [illegible] N. Y. CA $2,344,000 [illegible]

▲ Carete Constr. Corp., [illegible] CA $2,330,000 [illegible]

▲ Planet Constr. Corp., [illegible] N. Y. CA $2,004,000 [illegible]

▲ Planet Constr. Corp., [illegible] N. Y. CA $1,857,000 [illegible] PUBLIC SCHOOL 234, [illegible] 22 between [illegible] and 7th Ave., [illegible] Island City 1, N. Y. CD 12.13, under LB

▲ Laurence J. Rice, Inc., 61-40 [illegible] Ave., Maspeth, N. Y. CA $1,708,000 [illegible] Island City 1, N. Y. CD 12.11 under LB

▲ Wilaka Constr. Co., Inc., [illegible] N. Y. CA $1,832,000 [illegible] Island City 1, N. Y. CD 12.24 under LB

Jung Bros., Inc., 19 [illegible] A. $715,000 [illegible] Ave., PLAINFIELD, [illegible]

▲ Morris Novack, [illegible] $4,000,000 [illegible] MENT, Worth [illegible]

▲ Children's Hospital, [illegible] PITAL, [illegible] CD 12.28

Fleming Co., [illegible] $344,000 [illegible]

Futuramic Homes, Inc., [illegible] $350,000 [illegible]

▲ Terminal Constr. Co., [illegible] CA $7,621,743 [illegible]

▲ Faulkland Heights, [illegible] and Parking, [illegible] $2,000,000 [illegible] CORNER [illegible] St., Phila., Pa., [illegible]

SOUTH

HEAVY CONSTRUCTION—LB & CA

▲ VIRGINIA—The Richmond-Petersburg Turnpike Auth., 1015 E. Main St., Richmond, Va. S. J. Groves & Sons, Inc., [illegible] N. J., CA $3,216,696 [illegible]

(Continued on page 230)

How BEN HUR B

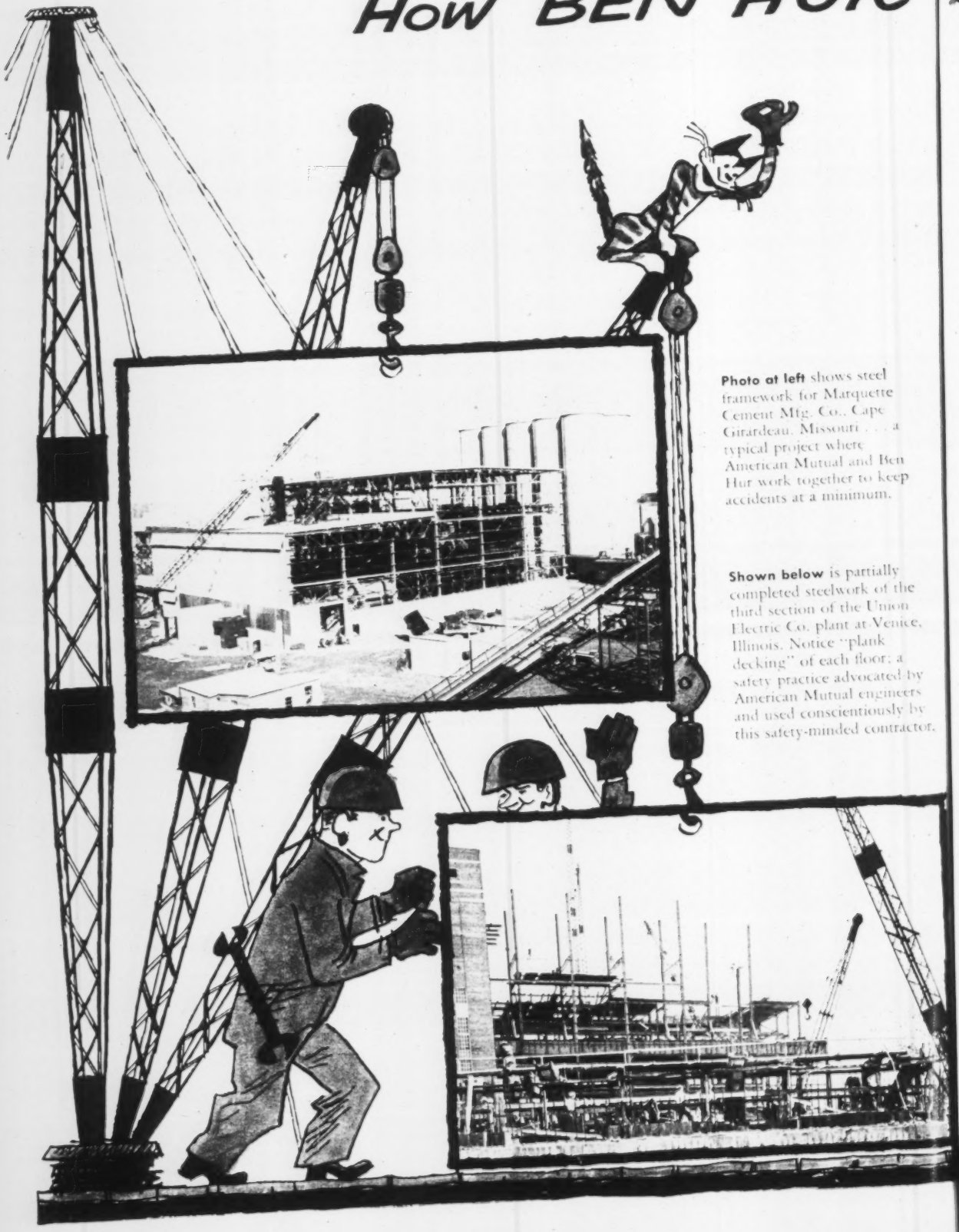


Photo at left shows steel framework for Marquette Cement Mfg. Co., Cape Girardeau, Missouri . . . a typical project where American Mutual and Ben Hur work together to keep accidents at a minimum.

Shown below is partially completed steelwork of the third section of the Union Electric Co. plant at Venice, Illinois. Notice "plank decking" of each floor; a safety practice advocated by American Mutual engineers and used conscientiously by this safety-minded contractor.

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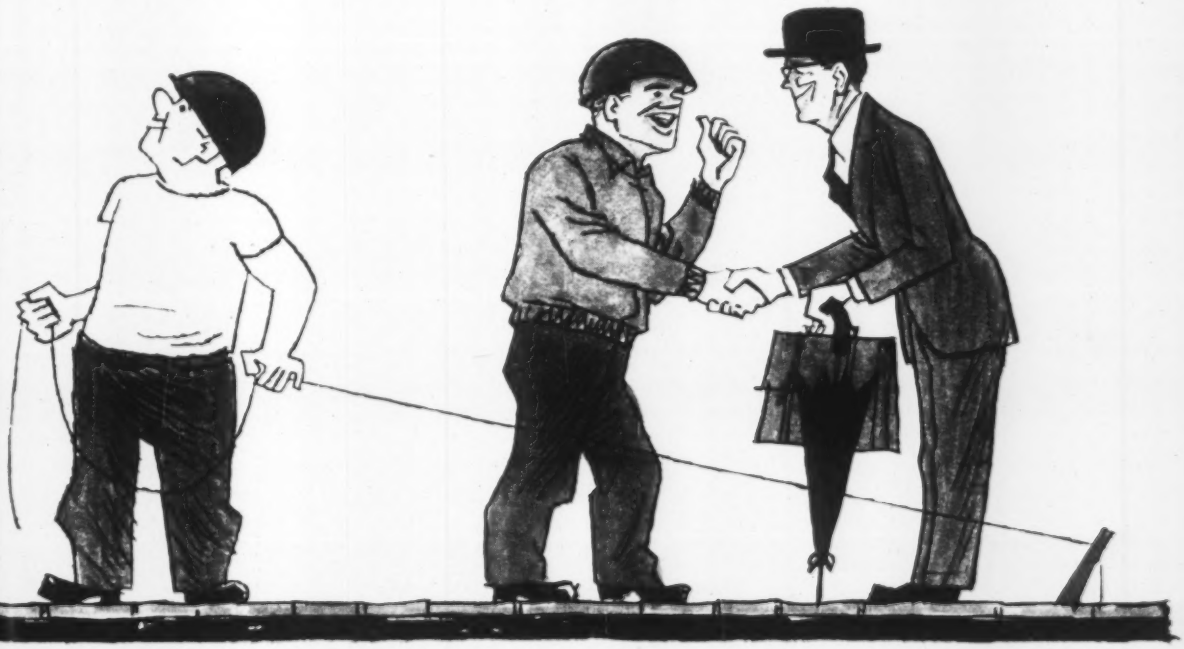

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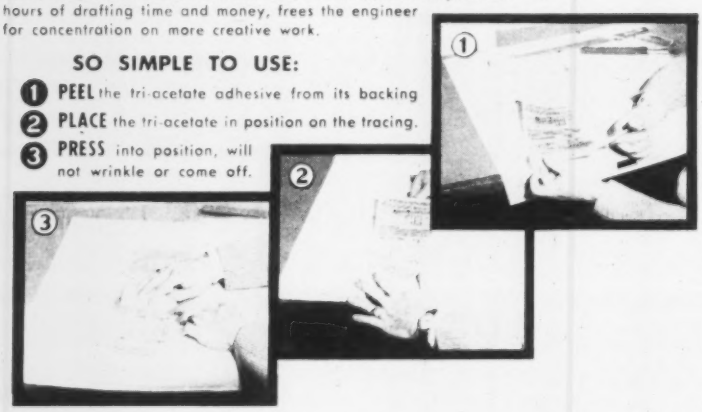

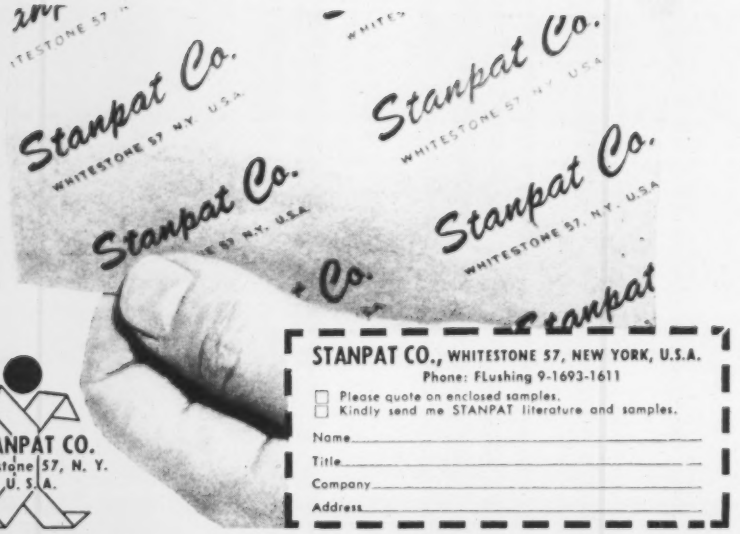

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(Continued from page 22)

† Neils L. Thon Co., [illegible] ... $458,000

† King-Hunter, Inc., [illegible] ... $464,400

† Tennessee Coal & Iron Div., U. S. Steel Corp., [illegible] ... $212,038

† Eastern Contractors, Inc., [illegible] CA $249,819

▲ ALABAMA
Ed Bentley, [illegible] ... $912,300

M. A. Evans Constr. Co., [illegible] $823,981

Hewitt Constr. Co., [illegible] ... $732,887

ALABAMA
Herbert Constr. Corp., [illegible] A $529,027

▲ Ala. Drydock & Shipbuilding Co., [illegible] CA $4,000,000

T. L. James & Co., [illegible] ... $770,451

Hoosier Eng. Co., [illegible] $352,065

BUILDINGS—LB & CA

Hardin & Traver Contractors, [illegible] LB $434,936

Louis Briggs Constr. Co., [illegible] LB $939,239

▲ Richard Fink, [illegible] CA $1,200,000

▲ Carr & Rothschild, [illegible] CA $1,904,000

▲ Daniel Constr. Co., Inc., [illegible] $3,591,000

▲ Williams & Dunlap, [illegible] $4,087,700

▲ V. L. Nicholson Co., [illegible] Tenn., CA $1,298,638

MIDDLE WEST

BUILDINGS—BA

O., Akron—STUDENT CENTER—BA ... Akron, 302 E. Buchtel St., Student Center, [illegible] alterations, $500,000. Plans deposit $5. Architects & Cassidy, 1961 W. Market St., Akron.

BUILDINGS—SLC

O., Springfield—HIGH SCHOOL, [illegible] Cincinnati, 424 Commercial Sq., Cincinnati, 2 stories, [illegible] contracts, 2 years, [illegible] $88,000; [illegible] remodel high school, $900,000. Bert S. Brokenger, 119 Scott St., Covington, Ky., [illegible] rejected. CD 12-6.

HEAVY CONSTRUCTION—LB & CA

Silas Campbell Co., Freeburg, Ill., CA ... other ground structures, installation of mechanized equipment for new River King Mine at Freeburg, [illegible] with rated capacity of 2,000,000 tons per year.

(Continued on page 232)

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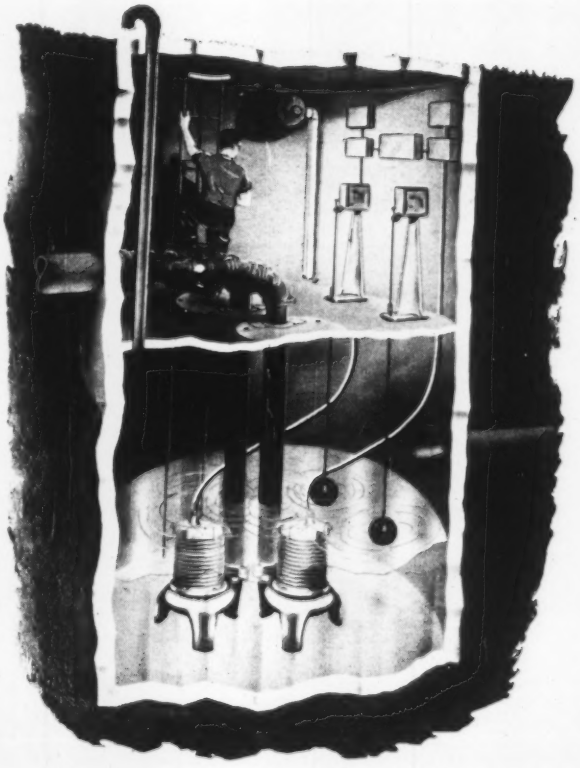

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Continued on page 230

BUILDINGS—LB & CA

Dorer-Burtell, $400,000

C. H. Johnson & Son Co., $505,516

▲ Foreman Constr. Co., $1,516,000

M. & D. Builders, CA, $366,919

Camay Constr. Co., $444,332

▲ Bru Shucket, $20,500,000

Mark Builders, $540,000

WEST OF MISSISSIPPI

HEAVY CONSTRUCTION—BA

† Missouri, BA 2

BUILDINGS—BA

▲ Tex., Pampa, HIGH SCHOOL, BA 1 11 — Pampa Independent School Dist., Pampa, Robert E. Lee Junior

▲ Okla., Oklahoma City, HOSPITAL, BA 2 24 — Iowa, Iowa City, BUILDINGS, BA 2 24

HEAVY CONSTRUCTION—LB & CA

IOWA, State Hy. Comm., Ames, Montgomery & Herberger, $134,873; F. A. Moser, Farmington, bridges, culverts, $226,056; Welden Bros., Iowa City, bridges, culverts, $395,410

▲ IOWA, State Hy. Comm., Ames, Fred Carlson Co., Decorah, $551,324; $272,912; $583,359; LB $110,057

Iowa, E. M. Duesenberg, Inc., Fort Dodge, LB $145,714; Pocahontas Co., LB $161,830

Iowa, Booth & Olson, Inc., Cedar Rapids, LB $412,168

Iowa, Fort Dodge Limestone Co., $158,349

Iowa, Slade Constr. Co., Fairmont, $907,708; $112,590; $144,202; $84,615; LB $142,201; $252,697

Iowa, Lee & Johnson, Inc., Iowa City, LB $83,887; LB $146,814

Iowa, Concrete Materials & Construction Co., Cedar Rapids, Iowa, $146,814; $42,148

Iowa, Hallett Constr. Co., $164,834

▲ Peter Kiewit Son Co., Ward, Minn., CA $676,563

Whittle Contg. Co., Dallas, Tex., CA $1,106,175

Hamby Excavating Co., Ward, Minn., CA $219,775

Fairbanks-Morse & Co., CA $416,125, LB; E. A. Pederson Co., CA $61,450, LB

† W. & L. Constr. Co., CA $344,900, Air Force Base, ENID, OKLA., Air Force Base, Vance Air Force Base

▲† Robert E. McKee General Contractor, Inc., Texas, El Paso, Tex., CA $1,295,742; Alamein No. 2, Bldg. A-1, 24-0, 57563, EL PASO, TEX.; Albuquerque, N. M., Bldg. 22, LB

▲ Hyde Constr. Co., Box 687, $2,090,000, Hospital, Piers 12, Galveston, Tex., The University of Texas, Bldg. 17, Galveston, Tex., Bids Dec. 17

BUILDINGS—LB & CA

† Fowler-Veranth Constr. Co., CA $542,300

† Bob Eldridge Constr. Co., CA $630,547

Hercules Constr. Co., $450,000

(Continued on page 236)

Get This NEW 24-Page Booklet on Carpullers!

It shows at a glance, how to compute the cable tension per thousand pounds of load, at level or on various inclines. It tells how much to allow for weight of car, curvature of track, condition of track and low temperature conditions. It suggests the proper type of rope or cable for different jobs, and gives a table showing the working strength of each, according to diameter.

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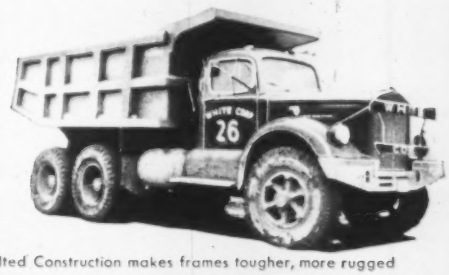

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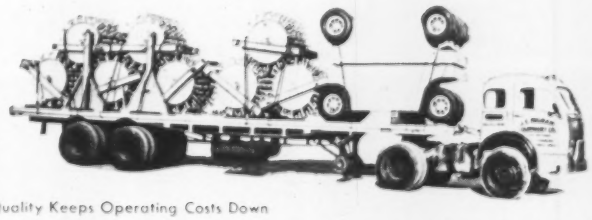

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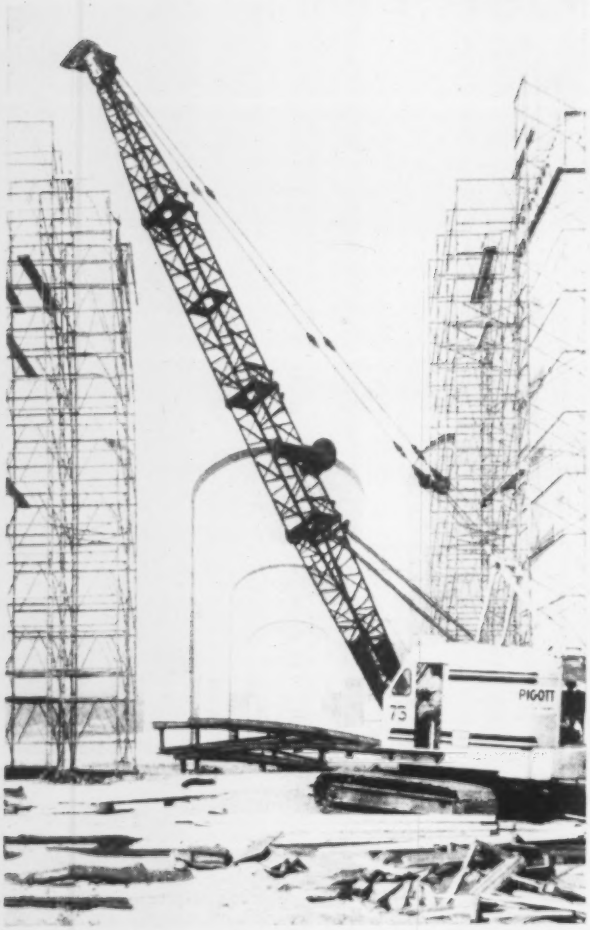

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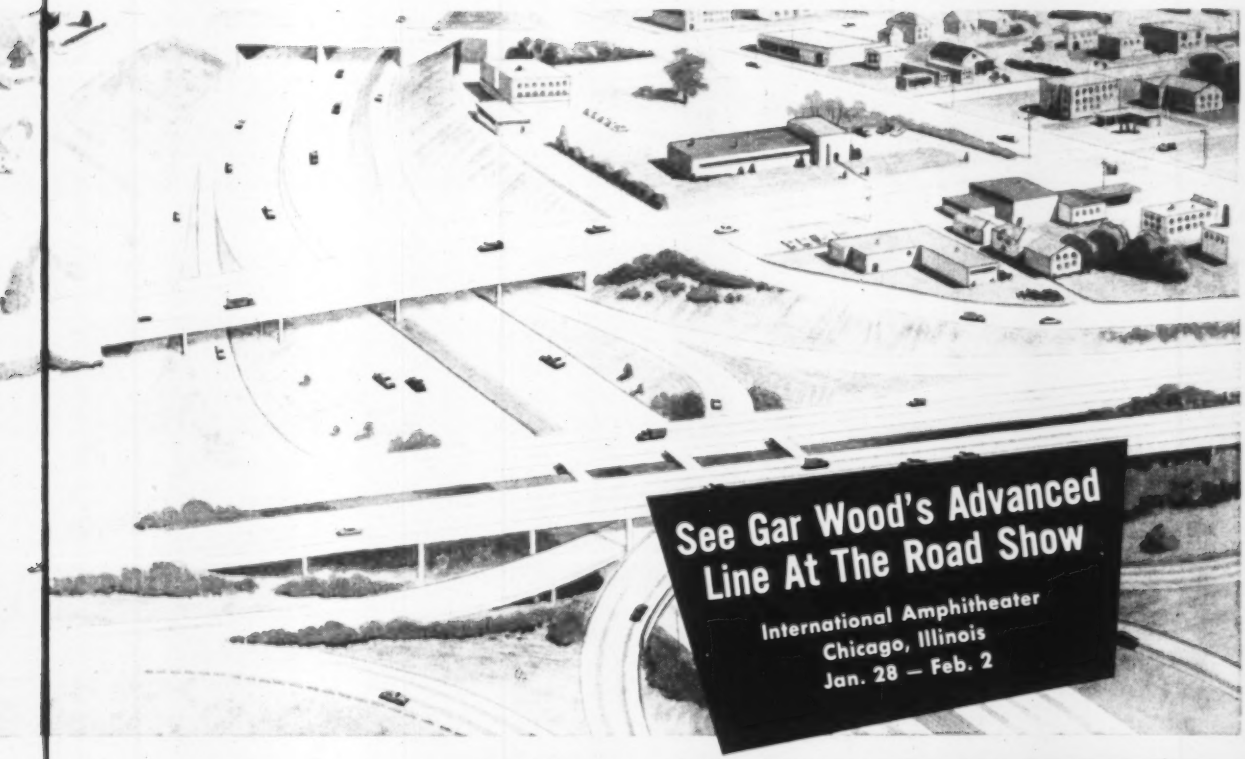

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INC. Wayne, Michigan

FINDLAY, OHIO; MATTOON, Ill.; RICHMOND, CALIF.

(Continued from page 232)

▲ MacDonald Constr. Co., $1,140,000

▲ V & V Constr. Co., $1,000,000

▲ Ebasco Services, Inc., $20,000,000

Austin Co., Inc., at Texas, $500,000

▲ Farnsworth & Chambers Co., Inc., 75 H..., Tex., CA $1,250,000

FAR WEST

BUILDINGS—BA

▲ Wash., Seattle

▲ Calif., Orange

Ariz., Fort Huachuca

BUILDINGS—SLC

▲ Calif., North Highlands

▲ Calif., San Jose, PLANT ... its contract,

HEAVY CONSTRUCTION—LB & CA

▲ WASHINGTON

C. J. Norris, $143,935

Grant Constr. Co., $79,903

J. W. Hallmon, $129,817

C. J. Painter, $96,658

H. Kathman, $277,423

J. J. Welcome Constr. Co., $538,225

▲ M. J. Kuney, N. 126 Pitch St., $1,834,670, ... CD 12/31

▲ J. G. Watt Co., ... $1,397,155, ... CD 12/19

▲† Clark-Sandkay-Birch, P.O. ..., $1,717,528, ... CD 12/19

Correction

CALIFORNIA

Norman J. Fadel, Inc., ... $977,644

▲ Guy F. Atkinson Co., ... $3,863,300, ... Bids Jan. 10, CD 12/27

J. S. Barrett, P.O. Box 212..., ... $834,500, ... 26 bidders, ... CD 12/18

† McDonald Bros., 2634 ... Blvd., ... CA $629,884, ... Bids Dec. 27, CD 1/2, under LB

A. Teichert & Son, Inc., 1941 Stockton Blvd., ... LB $709,725, 13 bidders, sewage pumping facilities, treatment works and trunk sewer, ... SACRAMENTO, CALIF., Municipal Sewer Improvement Dist. c/o Sacramento Co. County Office Bldg., Sacramento, Calif., CD 9/4

BUILDINGS—LB & CA

Louis Kowolowski, Madras, Ore., CA $588,000, 2 story SCHOOL WING, KLAMATH FALLS, ORE., Klamath Union High School Dist. 2, Klamath Falls, Ore., awarded Jan. 7, CD 12/28, under LB

G. E. Teufel Co., White-Henry-Stuart Bldg., Seattle 1, Wash., LB $693,600, 7 bidders, general contract, 1 one and 2 story steel frame bids, totaling 72,000 sq. ft., for Sunset JUNIOR HIGH SCHOOL, SEATTLE, WASH., Highline School Dist. 401, 253 S. 152 St., Bids Jan. 8, CD 12/19

▲ Sound Constr. & Eng. Co., 1400 Alaska St., Seattle, Wash., LB $2,355,346, 5 bidders, SPAR YARD FACILITY, SEATTLE, WASH., Boeing Airplane Co., 7755 E. Marginal Way, Seattle 4, Wash., Bids Jan. 10, CD 12/21

H. H. Johnson, Box 111, Chula Vista, Calif., CA $648,202, 49 frame, stucco DWELLINGS, Clairemont Tract No. 7, CHULA VISTA, CALIF., Hobart Enterprises, Box 111, Chula Vista, Calif.

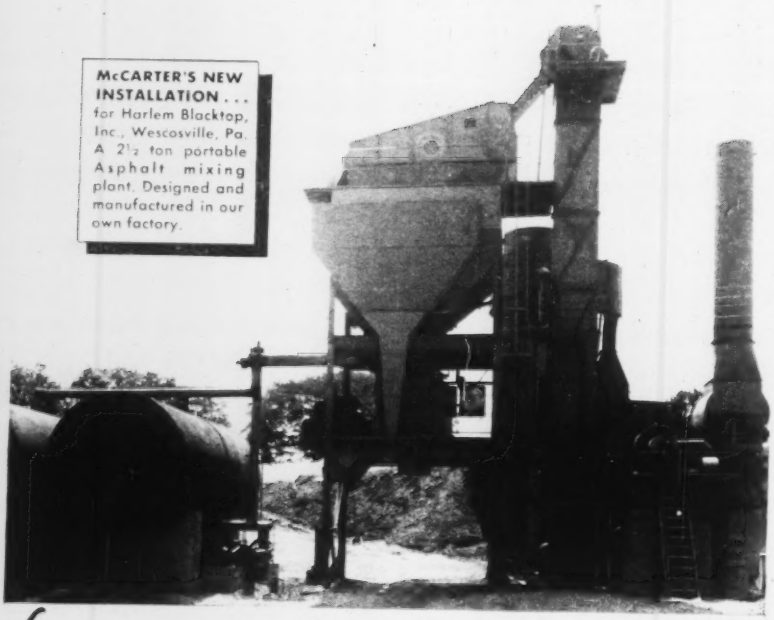
▲ A. C. Johnson & Sons, 25 4th St., Eureka, Calif., CA $1,175,962, 15 bidders, frame, stucco, structural steel, JUNIOR HIGH SCHOOL, EUREKA, CALIF., Eureka City Unified School Dist., 1915 J St., Eureka, Calif., Master, Hurd & Dunk, 526 Powell St., San Francisco, Calif., and Wm. Van Fleet, 350 ... St., Eureka, Calif., prints, CD 1/20

† B. H. Tanner, P.O. Box 1460, Monterey, Calif., CA $634,100, ... HALL, ... PORT, ... CALIF., ... Plumbing, ... Calif., Awarded Jan. 7, CD 1/7

▲ K & R Building Co., 270 S. Beverly Dr., Beverly Hills, Calif., CA $2,608,817, ... DWELLINGS, ... GARDENA, CALIF., ... 420 S. Beverly Dr., Beverly Hills, Calif.

G. M. Shumaker, 930 ... Blvd., ... Calif., CA $350,000, ... HOSPITAL, GARDENA, CALIF., ... Bids Jan. 8, CD 12/20

(Continued on page 238)



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for SPEED, PRODUCTION and PORTABILITY

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SPEED Goes up fast, dismantles easily with a minimum of crew.

PRODUCTION Full flexibility for the individual customer or for high tonnage runs.

PORTABILITY Sectioned for easy moving, large or small jobs, under varying conditions.

INDIVIDUAL UNITS AVAILABLE Dryers (hot or cold material) Mixers, Buckets, Hoppers, Bins, Feeders, Collectors, Elevators and Steel Structures.

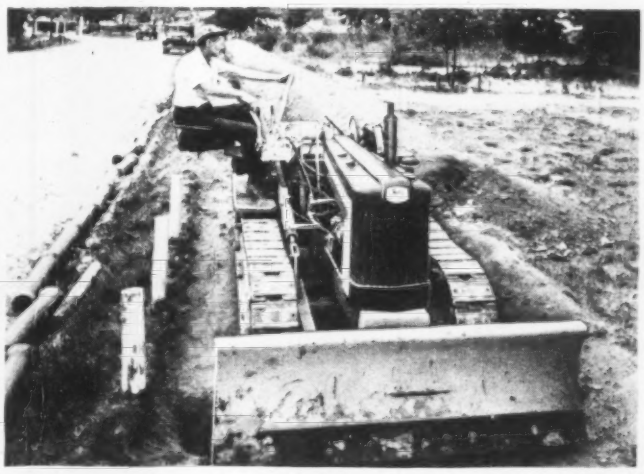
REPAIRING AND REMODELING Get better production, more efficient operation from your old plant. We specialize in this service.

Engineering Counseling available to you at no obligation. We can tailor our equipment to your specifications.

THE Mc CARTER IRON WORKS, INC. NORRISTOWN, PA.

POWER Aplenty

for MANY JOBS...at NEW LOW COSTS

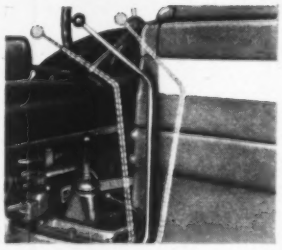


JOHN DEERE
Crawler Tractor

Compact, powerful, and low in first cost, the "420" Crawler is built to deliver years of dependable service at very low cost per hour. Ruggedly built. Easy to start. About 30 engine horsepower. Fewer parts to wear, easily serviced, very low fuel consumption. Your choice of 4- or 5-roller frame . . . track shoes to fit your needs. Optional equipment includes smooth, fast-working single or double hydraulic system, direction reverser, new 3-point hitch for rear-mounted equipment, and 5-speed transmission. Wide choice of matched working equipment for nearly all jobs, including John Deere Loader, at left.

JOHN DEERE
Utility Tractor

This wheel-type, stay-on-the-job power unit can boost your profit margin on many kinds of work. Low in first cost, low in upkeep, remarkably low in fuel costs. Cuts "down time" to a minimum because of simple, rugged construction. Highly maneuverable. Has unusual stability when carrying loader, backhoe, or similar equipment. Built low—easy to get on and off, sure-footed on slopes. Optional equipment includes direction reverser, 5-speed transmission, and power-adjusted rear wheels. Shown with loader and backhoe. 3-point hitch regular.



DIRECTION REVERSER
. . . a Real Time-Saver

Optional for Crawler and Utility tractors. Lets you move forward or backward in same speed without shifting gears. Investigate—you can save as much as an hour a day in travel time on loading, dozing, and many other jobs!

. . . Now Ready for You!

Some of the Equipment Available

Loaders	Scrapers	Sweeper	Seeders
Scarifiers	Trenchers	Crane	Scoop
Backhoes	Generator	Snow Plows	Fork Lift
Dozers	Pump	Sprayers	Power Saw
Cutter-Bar Mower		Cement Mixer	Gang Mower

John Deere Industrial Division
Moline, Illinois

JOHN DEERE
Industrial
Tractors and Equipment

Backed by nearly 40 years of tractor manufacture for dependable service and quality.

BUILD BETTER ROADS TODAY · FOR A GREATER AMERICA ·

See you at the ROAD SHOW CHICAGO Jan. 28-Feb. 2, 1957

AMERICAN ROAD BUILDERS ASSOCIATION

BOOTH 835
DONOVAN HALL

No *ordinary* cooling system could have done it! To help make Wisconsin Engines first choice everywhere, it took a *special* system with these *finer points.*

- A high-capacity fan, integrally cast with flywheel, pushes more air through engine.
- Time-engineered, time-tested cooling fin design integrally cast in cylinder blocks and heads.
- Scientifically designed and placed air shrouding, providing correct heat dissipation.

The result . . . trouble-free operation, sub-zero to 140° temperatures. Write for S198 . . . handy service map and list of approved service stations.

ALL-CLIMATE

Air Cooling

...another reason why

WISCONSIN ENGINES rank 1st in the world, 3 to 36 hp.

WISCONSIN MOTOR CORPORATION
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

Better Performance Depends on Better Features....

The BELMONT IRON WORKS

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BUILDINGS & BRIDGES
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PIERS

WIRE OR PHONE FOR A QUOTATION ON YOUR NEXT FOUNDATION JOB

ANYWHERE IN THE WORLD
OFFICES IN
ATLANTA, GA. • PITTSBURGH, PA.
WASHINGTON, D. C.

(Continued from page 236)

Fluor, Grove & Savage, 8440 Melrose St., Los Angeles, Calif. engrs-contrs.

Dike & Colgrove, 414 E. 17 St., Costa Mesa, Calif. CA $383,800. (6 frame, stucco) DWELLINGS, E. Ave. (Lots N. Lauden, E. Palmdale) PALMDALE, CALIF. Orange Coast Development, 414 E. 17 St., Costa Mesa, Calif.

▲ C. L. Peck, 826 W. 5 St., Los Angeles 17, Calif. CA $1,200,000. 2 story, about 214,000 sq. ft. research and production (PARKING-RECEIVING BLDG.) PASADENA, CALIF. Bldg. Inc., 1000 Bonita Ave., S. Lake St., Pasadena, Calif. Welton Becket & Assoc., 5967 Wilshire Blvd., Los Angeles, Calif., archts.

Beverly Development Co., 9644 W. Olympic Blvd., Beverly Hills, Calif. CA $380,000. 40 DWELLINGS, 11400 E. Joy Rd., Pioneer Tr., 20944, PUENTE, CALIF. Beverly Mutual Homes, Inc., 8644 Wilshire Blvd., Beverly Hills, Calif. Martin Stern, 8325 Wilshire Blvd., Beverly Hills, Calif., archt.

▲ Dunn Constr. Co., 109 Iowa, St., San Francisco, Calif. CA $5,725,000. 250 HOMES, site south of Bayside School, SAUSALITO, CALIF. Owner, Title Insurance

CANADA

HEAVY CONSTRUCTION—BA

Ontario—BA 2-5—St. Lawrence Seaway Auth., No. 2 Temporary Bldg., Ottawa, dredging approaches at Iroquois Lock in International Rapids Sect. of the Seaway, near Iroquois. A. G. Murphy, 685 Cathcart St., Montreal, Que., chf. engr. of owner.

HEAVY CONSTRUCTION—LB & CA

▲ ONTARIO—Dpt. Hys., Parliament Bldgs., Toronto, Ont.—Peel Constr. Co. Ltd., Hy. 7 west, Brampton, Ont. LB $409,349 (15 bidders) granular base, hot mix paving 3.9 mi. Hy. 7, Kitchener east to Breslau, Contr. 56-94. LB $422,842 (10 bidders) granular base, hot mix paving 5.6 mi. Hy. 11, Orillia bypass to Washago bypass, Contr. 56-201;

Ont.—Curran & Briggs, Ltd., 61 Haverson Blvd., Toronto, Ont., LB $976,302 (5 bidders) grading, culverts, granular base 11.7 mi. Hy. 129, 7 mi. south of Chapleau on Chapleau Rd., westerly to Wanapitei Lake, Contr. 56-211;

Ont.—Fort York Constr. Co. Ltd., 2498 Yonge St., Toronto, Ont., LB $349,438 (6 bidders) grading, culverts and granular base 3.75 mi. New road, junction Hy. 17 to Heron Bay, Contr. 56-205;

Ont.—Sterling Constr. Co. Ltd., 2344 Riverside Dr. E., Windsor, Ont., LB $504,631 (7 bidders) granular base, hot mix paving 5.77 mi. Hy. 8, Seebach to Mitchell, Contr. 56-277;

Ont.—Croydon Constr. Ltd., Box 25, Beardmore, Ont., LB $119,299 (3 bidders) grading, gravel and culverts 5 mi. Access Rd., Nakina, south from Mile 14 to 19, Cont. 56-152. Bids Jan. 9. CD 12-12.

J. P. Porter Co., Ltd., 1010 St. Catherine St. W., Montreal, Que., CA $642,600, suction dredging Station 0 plus 00 to Lock No. 1, Welland Ship Canal, Welland, ONTARIO St. Lawrence Seaway Auth., No. 2 Temporary Bldg., Ottawa, Ont. Bids Dec. 18. CD 12-26, under LB.

BUILDINGS—LB & CA

Alexander Constr., Ltd., 10548 82nd Ave., Edmonton, Alta., CA $345,546 (8 bidders) DORMITORY No. 3 at Deerhome Institution Hospital, RED DEER, ALTA. Dpt. P. Wks., Parliament Bldgs., Edmonton, Alta. Bids Dec. 20, awarded Jan. 3. CD 11-29.

▲ Pigott Constr. Co. Ltd., Pigott Bldg., Hamilton, Ont. CA Est. $1,826,000. STEEL MILL EXPANS. (1) extens. of 200 ft. to pickle line bldg., (2) 100 ft. exten. to coil storage bldg., (3) new reversing mill and annealing plant, (4) new temper mill bldg. HAMILTON, ONT. Steel Co. of Canada, Ltd., Wilcox St., Hamilton, Ont. CD 11-29-56.

▲ Dunker Constr. Co. Ltd., 176 Louisa St., Kitchener, Ont. CA Est. $1,250,000 (7 bidders) 1 story, 241'x404' ft. WAREHOUSE 2 story, 110'x175' ft. OFFICE, steel frame, brick, block constr., KITCHENER, ONT. B. F. Goodrich Canada, Ltd., 251 King St. W., Kitchener, Ont. Bids Jan. 8. CD 12-28.

▲ Thomas Fuller Constr. Co. Ltd., 149 Richmond Rd., Ottawa, Ont. CA $2,398,594 (11 bidders) ADMINISTRATION BLDG., for Dpt. Mines & Technical Surveys, on Booth St., OTTAWA, ONT. Dpt. P. Wks., Hunter Bldg., Ottawa, Ont. Bids Nov. 22, awarded Jan. 8. CD 11-28, under LB.

Ellis-Don, Ltd., Box 592, London, Ont. CA $645,000. 2 story, basic 103'x156' ft., steel frame, etc., FEDERAL PUBLIC BLDG., poured concrete fdn., ST. THOMAS, ONT. Dpt. P.W. Wks., Hunter Bldg., Ottawa, Ont. Bids Nov. 28, awarded Jan. 4. CD 12-6, under LB.

▲ Louis Donolo (Ontario) Ltd., 2740 Dufferin St., Toronto, Ont. CA $1,000,000 (5 bidders) 2 story, 180-bed, concrete block and poured concrete fdn., masonry, REST HOUSE for AGED, TORONTO, ONT. Salvation Army, 20 Albert St., Toronto, Ont. Bids Dec. 28, awarded Jan. 9. CD 12-18.

Roland & Chalifoux, Ltee., 4275 Papineau Ave., Montreal, Que. CA $661,000, 2 story, 115x240 ft., structural steelframe, stone trimmed brick walls, Arts and Trades SCHOOL, concrete fdn., LONGUEVILLE, QUE. Dpt. Youth & Social Welfare, Quebec City, Que. Bids Nov. 13, awarded Jan. 7. CD 12-28, under LB.

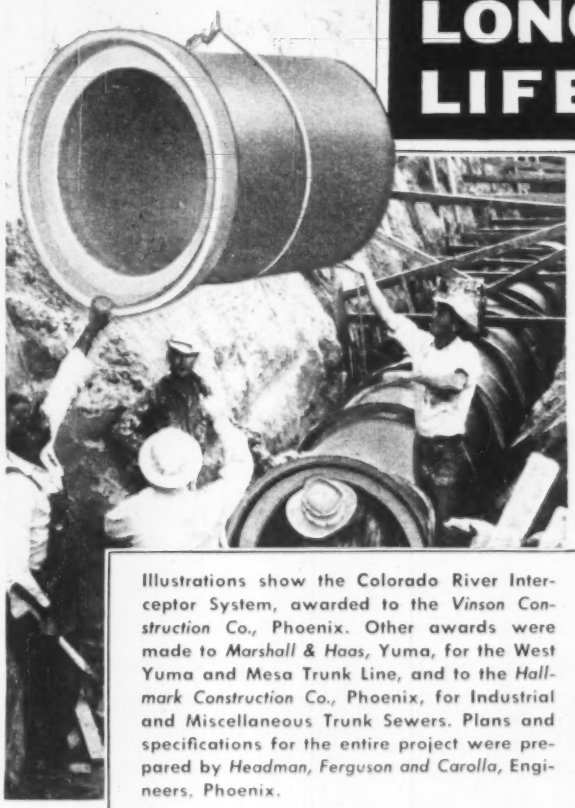
AMERICANS ABROAD

BUILDINGS—LB & CA

Chemical & Industrial International, Ltd., Nassau, Bahamas, CA 250 ton per day nitric acid PLANT, STANFORD-LE-HOPE, ENGLAND. Fisons, Ltd., Har-

(Continued on page 243)

LONG TERM BOND FINANCING calls for LONG LIFE CLAY PIPE



Illustrations show the Colorado River Interceptor System, awarded to the *Vinson Construction Co.*, Phoenix. Other awards were made to *Marshall & Haas*, Yuma, for the West Yuma and Mesa Trunk Line, and to the *Hallmark Construction Co.*, Phoenix, for Industrial and Miscellaneous Trunk Sewers. Plans and specifications for the entire project were prepared by *Headman, Ferguson and Carolla*, Engineers, Phoenix.

YUMA, ARIZONA, is installing a new $1,600,000 sewer system and pumping plant, designed to meet the demands of its rapidly growing populace. Financed by a bond issue, the project calls for 14 miles of Vitrified Clay Pipe, in diameters up to 36 inches, serving both industrial and residential areas.

When dealing with bond-financed improvements, consulting engineers and civic planners can't afford to take chances. They have to choose materials they know will last. That's why the choice everywhere is Vitrified Clay Pipe. It's the one pipe you can be sure will still be in service long after the bonds have been retired. It's the one pipe that can stand up under the corrosive action of sewer acids and gases . . . can't corrode or disintegrate . . . can't wear out. Its long-term guarantee—*exclusive* with Vitrified Clay Pipe—is striking proof of its superiority.

THE PUBLIC *KNOWS* CLAY PIPE IS BEST

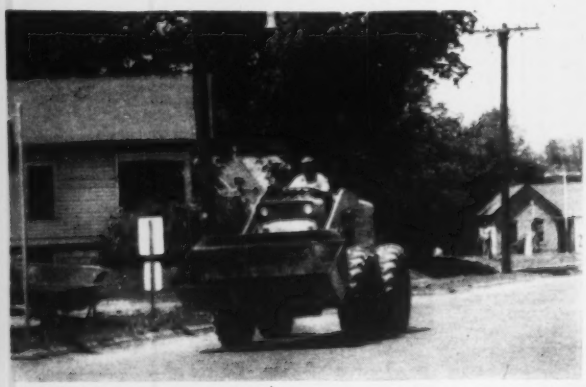
Vitrified CLAY PIPE

NATIONAL CLAY PIPE MANUFACTURERS, INC.
1820 N. Street, N.W., Washington 6, D.C.
206 Connally Bldg., Atlanta 3, Ga.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio

Costs of city work seem too high?

LOOK HOW SANGAMO CONSTRUCTION CO. CUTS THEM

This well-known 30-year-old Springfield (Illinois) firm, a year ago, had a problem common to most city-area contractors. Moving costs and traffic slow-downs were taking much of the profit out of their municipal work. Small, extra, one-day or weekend jobs, which *could* have built income, often couldn't be handled because, like many contractors, their equipment was either too small or too big. Sangamo, however, found a solution. They bought Michigan Tractor Shovels. Today, their $3,000,000 annual volume is *largely* in city work and *three* of their busiest, most profitable machines are Michigans.



Drive, turn non-stop on narrowest city streets

All these units can be on their way to any kind of loader job in minutes. "These rigs go anywhere," says Clyde Turner, one of Sangamo's job superintendents. "They can run three or four blocks, through auto and truck traffic, in a minute or so. Twenty-seven miles takes only an hour. Rubber tires don't tear up asphalt or oil-mat pavement. They can even go up on a sidewalk without breaking it or the curbing. And our Model 75A's (which are 6' 8" wide and 16' 10" long) can turn around nonstop on the narrowest city streets."

Does job of bigger machines setting 12 inch sewer pipe

Often, one of the Michigans is assigned to a major job where maneuverability is a vital factor in speeding completion. Above picture shows typical task of this type —laying eight miles of 8, 10, and 12-inch sewer pipe for the city of Decatur (Illinois). Daily—almost hourly—this Model 75A shuttled between *three* crews. Tasks included pushing spoil away from trencher . . . back-filling . . . transporting and laying pipe. At times, it set manholes weighing 1200 to 1500 lbs per ring section. Biggest advantages proved to be speed (a typical half-mile trip took 75 seconds) . . . rugged construction (in a summer of work, no time was lost from the job for repairs) . . . planetary axles (which eliminated all axle breakage despite rugged lifting demands)

Carries 1800 lb water main section

Bigger loads have been no problem for the Michigans, either. Above, the second of Sangamo's 80 hp Model 75A's carries an 1,800 lb, 18 ft section of 20 inch water main. This unit *can* lift 8,000 lbs while standing still . . . can carry 4,000 lbs at 4 mph.

Clears, loads 1,000 yards of rubble in 1½ days

Sangamo's third Michigan Tractor Shovel, a 95 hp, 1⅝ yard Model 125A, also handles assignments where speed is important. Here it's on a historical job in Springfield—clearing the wreckage of Illinois' first governor's mansion to make way for a parking lot. Entire 1,000 cubic yards of rubble and dirt was piled and loaded out in 1½ days. Sangamo Construction bought this machine, their first Michigan Tractor Shovel, after having it demonstrated (to quote Company President, Bill Kewley) "on the toughest tractor shovel work we could find—digging up wet rocky ground to improve drainage around a Springfield sewage treatment plant. Later," Kewley continues, "it proved so handy and so dependable, all our crews wanted one. So, in 5 months, we bought our second Michigan, and 3 months later, our third."

Full buckets are the trademark of all Sangamo's Michigans. Here the Model 125A, bin-storing hot mix material, carries *more* than its rated 1⅝ yard capacity. Unexcelled breakout force, low-level tipback, and low-level-carry result in the delivery of big loads every time, the operator says.

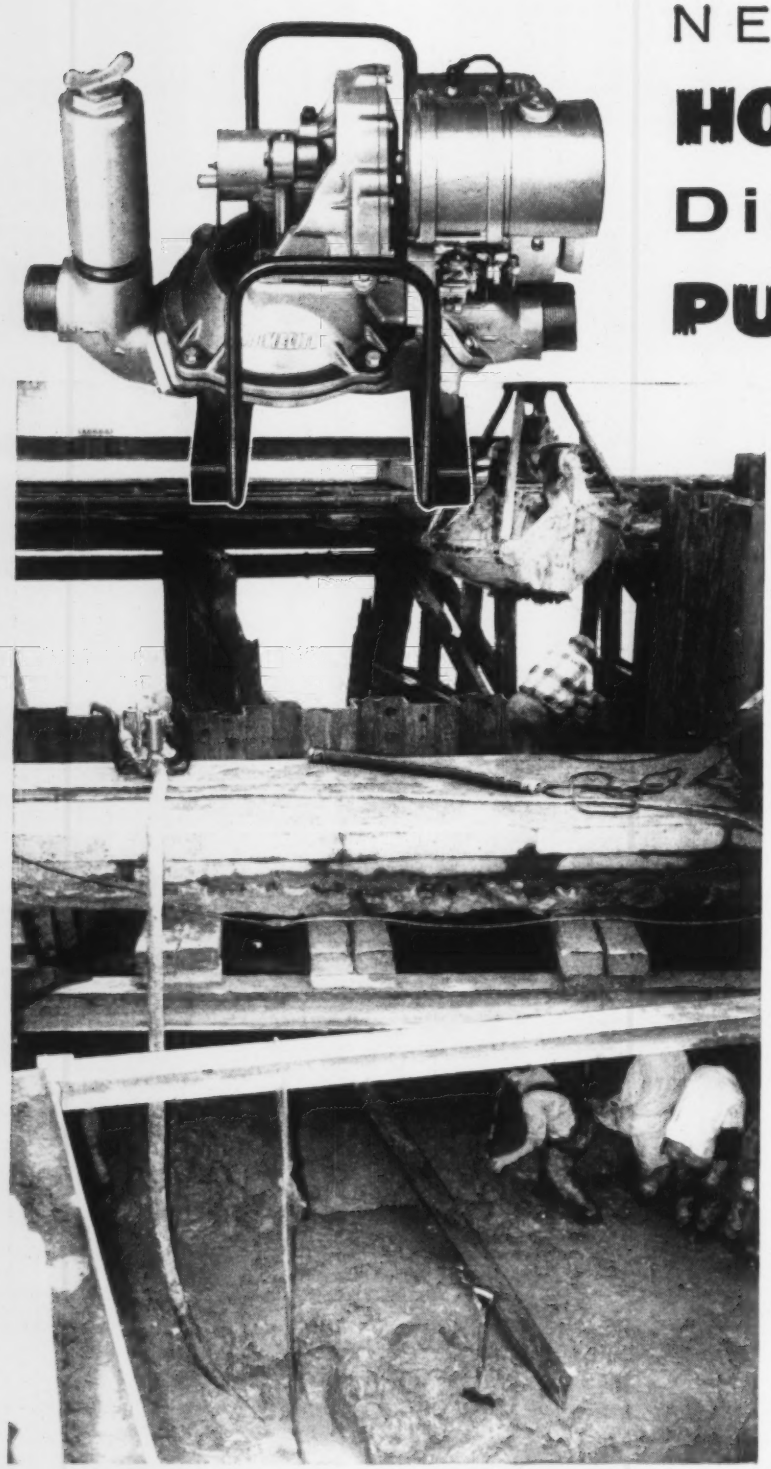
Stockpiling gravel is another job for the busy Model 125A. While at this city-located yard, rig sometimes loads trucks and railroad cars, feeds the crusher, does cleanup. Its standard 1⅝ yard bucket, incidentally, is interchangeable with 2 yard light-material bucket.

The model 75A's standard 1 yard bucket interchanges with ¾ and 1½ yard sizes. Both models can also be equipped with crane hooks, fork lifts, backfiller blades, scarifiers and root rakes. For small jobs you can get a Michigan Model 12B with 6, 10, 15, 20, or 27 cubic *foot* capacity . . . for big jobs you can get a Michigan Model 175A with 1⅝, 2, 2¼ (standard), 3 or 5 cubic *yard* capacity. For help in determining which of these four models, or which of their 35 different buckets and attachments, *best fits your needs*, ask one of our job study engineers to study your layout. Feel free to call or write us any time for this service. It's free, of course and realistic . . . and will put you under no obligation whatsoever.

CLARK® EQUIPMENT

Michigan is a registered trademark of

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2401 Pipestone Road
Benton Harbor 35, Michigan



NEW HOMELITE Diaphragm PUMP

for All Heavy-Duty jobs*

This new, job-tested Homelite diaphragm pump will handle *all* your heavy-duty jobs with greater ease and mobility.

Its new internal design not only pumps up to 5000 gallons per hour but handles sand, mud, solids and muck with equal ease. Because it weighs only 120 pounds, it goes anywhere quickly and easily . . . saves money in labor and haulage costs.

The entire unit construction is keyed to smooth, continuous performance. Flapper valves have special self-cleaning action to prevent clogging. The accumulator holds flow at a steady rate. Gears are totally-enclosed for full protection. Spring skids provide steadier footing, reduce vibration.

Write or call your nearest Homelite representative for complete information or a free demonstration.

**120 pounds for easier carrying*

Model 20DP3 has guaranteed suction lift up to 28 feet and total head up to 50 feet, including friction.

Manufacturers of Carryable PUMPS GENERATORS BLOWERS CHAIN SAWS

HOMELITE

A DIVISION OF TEXTRON INC.

1101 RIVERDALE AVE., PORT CHESTER, N. Y.

Complete Line of Homelite Carryable Construction Equipment Now Available

Self-Priming Centrifugal Pumps . . . Carry these lightweight, dependable pumps anywhere. Non-clogging design . . . 28 foot suction lift . . . capacities up to 15,000 g.p.h. . . . sizes from 1½" to 3". Diaphragm pump also available.

Chain Saws For Every Job . . . Now you can choose from a full line of lightweight, powerful Homelite chain saws. From 3½ to 7 horsepower . . . 19 to 29 pounds. Brush cutting and clearing attachments are available to handle all your cutting jobs.

Carryable Gasoline Engine-Driven Generators . . . Lightweight Homelite generators can be carried and used anywhere to provide high-cycle and 115 volt power for your electric vibrators, tools, and floodlights. Complete range of sizes up to 5,000 watts . . . all standard voltages.

HOMELITE

a division of Textron Inc.

PORT CHESTER, NEW YORK

PROPOSED PROJECTS

WATER SUPPLY

▲ Mich., Grand Rapids—[illegible] Water Authority, Grand Rapids, Lake Michigan pipe line, [illegible] Water Authority, Wyoming, Kent County Water Authority, Grandville, Hudsonville and Zeeland, [illegible] $22,500,000. Black & Veatch, 4706 Broadway, Kansas City 12, Mo., consult engr.

SEWERS, WASTE DISPOSAL

▲ Ala., Troy—City, City Hall—sewage disposal plant and main sewer lines, $1,000,000.

▲ Colo., Denver—City and Denver Co., City & County Bldg.—sewer dist. in South and Southwest Denver, $7,800,000. Dewey Wright, city engr.

▲ Fla., Lake Worth—City, City Hall—comprehensive sewer plan, $5,500,000. Russell & Axon, Professional Arcade, Daytona Beach, consult. engrs.

▲ Mich., East Detroit—City, Charles Pearson, engr.—storm sewers, flood relief program, $3,000,000. Harry J. Fuller, 221 St. Clements Island Bank Bldg., Mount Clemens, consult. engr.

▲ Mo., Joplin—City, $1,500,000 bond election Feb. 14. Sanitary sewer expansion. Ahlgren, Martin & Ahlgren, 1204 Main Str., Joplin, consult. engrs. (O

BRIDGES

▲ N. Y., New York—Dept. P. Wks., Municipal Bldg., Zone 7—new Broadway Bridge over Harlem Ship Canal, Proj. 52, $12,666,000. To go ahead in 1958, [illegible]

STREETS AND ROADS

▲ ILLINOIS—Illinois State Toll Hy. Comm., [illegible]

Cook, Boone, DuPage, Lake, Kane and Winnebago Counties—reconstruct and service stations, $18,250,000. Public Address, 56 W. Jackson Blvd., Chicago, consult. engr.

▲ Ill., Franklin Park—Village, paving 24 mi. village streets, $2,300,000. Edwin Hancock, 1504 W. Jackson Blvd., Chicago, engr. CD 1-22-57

▲ KENTUCKY—Commonwealth of Ky., Dept. Hwys., Frankfort:

Jefferson Co.—Outer Eastern Parkway, in connection with Louisville Watershed, $3,000,000.

Widen Outer Eastern Parkway to 4 lanes from Outer Parkway to Watterson Expressway, Louisville, $600,000. CD 1-15-57

▲ O., Cincinnati—City, City Hall,

Elmhurst-Lawnview, 36 ft. concrete street, necessary water mains, water lines, $124,500, May go ahead summer of 1957.

Central Parkway, widen and reconstruct between Eggleston and 14 Sts., $320,000, May go ahead in summer of 1957.

Copley-Sutton Ave., improve from Beechmont to Glade Sts. with 36 ft. roadway, $400,000; with 36 ft. roadway within 80 ft. right of way, $1,250,000. T. J. Montgomery, city engr. CD 11-9

▲ Tex., El Paso—City, City Hall, street improvements, $1,685,000. CD 10-18-51

EARTHWORK, WATERWAYS

▲† Idaho—U. S. Bureau Indian Affairs, 1002 N. 4th Ave., Portland, Ore., [illegible] Lateral Blvd., Portland, Ore., [illegible] Main Lateral and 4,300 ft. of discharge line for Michaud Irrigation Proj., $1,000,000. Bids in spring or summer.

▲ Tex., Corpus Christi—City, City Hall, [illegible] for North Beach, [illegible] $1,000,000. Goodrich Engineering Co., [illegible] engr.

▲ N. S., Annapolis Royal—Nova Scotia Power Comm., Province of Nova Scotia, power dam across Annapolis River, $4,300,000.

AIRPORTS

▲ Tex., Corpus Christi—AIRPORT TERMINAL—City, City Hall, plans by Donnell & Wurtzel, 2220 Wilson St., and Reagan & McCallum, Wilson Bldg., airport terminal, $4,600,000. Frank T. Dougherty, 142 W. Olmos Dr., San Antonio, consult. engr. CD 12-4

▲† Tex., Lackland Air Force Base—LANDSCAPING DEVELOPMENT—U. S. Eng., Box 2289, Galveston, plans by Stewart E. King, archt.-consult. engr., 528 Kirby Bldg., San Antonio, [illegible] design for [illegible] hospital and training addn., Tex., $3,000,000. CD 8-21

▲ Que., Sherbrooke—AIRPORT—Dpt. Transport, Motor Bldg., Ottawa, Ont., airport, $750,000-$1,250,000.

LATIN AMERICA

▲ Brazil—[illegible] Valley Development Corporation and the Central Electrical Power Agency, will soon [illegible] the planned [illegible] of the Mairinque-Para 24 kilometers long, 64 meters high. A 500,000 kw. hydroelectric [illegible] is also to be constructed at site, $120,000,000.

▲ Mexico, Uruapan—FACTORY, etc.—National Financiera, S. [illegible] 25, Mexico City, plans paper factory and saw mill, $32,000,000.

Consult with Griffin's engineers.

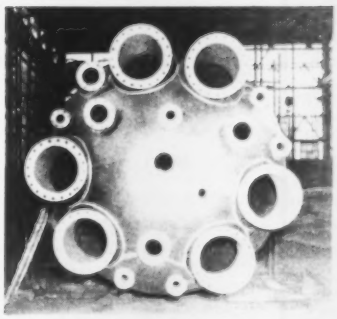
Ground water analysis and pre-bid estimate —no obligation.

GRIFFIN

WELLPOINT CORP.

881 East 141st Street, New York 54, N. Y.

Hammond, Ind., Houston, Tex., Jacksonville, Fla.



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● Whatever your need in pressure vessels, lumber-treating cylinders, storage tanks, processing or chemical vessels—of your special or conventional design, you can depend on COLE for vessels built in strict accordance with ASME Code . . . from aluminum, stainless or carbon steels, and alloys. Write for *Tank Talks*.

COLE

R. D. COLE MFG. COMPANY

Newnan, Ga.

FOREIGN

▲ Netherlands, Amsterdam—TUNNEL—Amsterdam Public Works Dept., Tunnel Constr. Sect., Amsterdam, plans for tunnel to be under the IJ river to connect Amsterdam with northern section of city, 1½ tunnel tubes, each 2,625 meters long, 8.25 meters diameter, 4 traffic lanes each; start mid-1957. Contract period 5½ years. Bids in 1957.

PUBLIC BUILDINGS

▲ Calif., Coalinga—JUNIOR COLLEGE—Coalinga Union High School and Junior College Dist., San Jose Ave., plans by Walter Wagner & Partners, architect-engr., 1410 San Jose Ave., Fresno, Junior College, $2,604,000.

▲ Calif., Daly City—SCHOOL—Jefferson Union High School Dist., c/o Supt., 375 S. Mayfair St., 4 High Schools, $12,000,000.

▲ Calif., El Cajon—SCHOOL—Cajon Valley Union School Dist., El Cajon Junior High School, $1,029,618.

▲ Colo., Denver—MEDICAL CENTER—University of Colorado, Gannon, Boulder, plans by Schmidt, Garden & Erickson, 104 S. Michigan Ave., Chicago, Ill., expand medical center, $7,000,000-$10,000,000.

▲† D. C., Wash.—ADMINISTRATION—General Services Administration, Services Bldg., Wash., 25, D. C., veterans administration bldg., Vermont Ave. and H St., N.W., $2,100,000. A. Hendler Co., Inc., 1023 20th St., N.W., contractor.

▲ Ga., Marietta—COURTHOUSE, etc.—Cobb Co. Comrs., Marietta, 4-story courthouse and garage to be erected a block behind the old, outmoded quarters, 6 courtrooms, $2,000,000.

▲ Ind., Gary—LIBRARY—Gary Public Library, 220 W. 5th Ave., plans by Bruce, Hall & Curran, 667 Broadway, library, $1,000,000.

▲ Minn., Chatfield—SCHOOL—Bd. Educ., E. S. Gordon, clk., plans by Swanson & Wegleitner, 500 Sexton Bldg., Minneapolis, school, $1,200,000. To go ahead in 1957.

▲ Mo., Belton—SCHOOL—Bd. Educ., plans by Terrell & Olsen, 1016 Baltimore Bldg., Kansas City, Mo., high school, $1,000,000.

▲ N. J., Newark—GARAGE—City of Newark Parking Auth., City Hall, plans by Frank Grad & Sons, 11 Commerce St., garage for parking under Military Park, 3-level structure, $2,000,000. CD 11-5.

▲ N. Y., Brooklyn—LIBRARY—Dpt. P. Wks., Municipal Bldg., New York, Zone 7, plans by Francis Keally & Howard S. Patterson, 17 E. 49 St., New York, Zone 17, Proj. L-23, Downtown Branch Brooklyn Public Library, $2,670,000. To go ahead in 1958. CD 1-29-54.

▲ N. Y., Far Rockaway—SCHOOL—Bureau Constr., Bd. Educ., 42-15 Crescent St., Long Island City, plans by Louis E. Jallade, 547 Fifth Ave., New York, Zone 17, Proj. E-744, addn. to Far Rockaway High School, $2,200,000.

▲ N. Y., Flushing—MUSIC and ARTS—Bd. Higher Educ., City College, Brett Hall, 13th and Convent Ave., New York, Zone 31, plans by Feilheimer & Wagner, 155 E. 42 St., New York, Zone 17, music and arts bldg., Queens College, Proj. HN-100, $5,000,000. To go ahead in 1957.

▲ N. Y., Flushing—SCHOOL—Bureau Constr., Bd. Educ., 42-15 Crescent St., Long Island City, plans by Dercole & Cavaliere, 384 E. 149 St., New York, Zone 55, addn. to and conversion of P. S. 24, Proj. S-346, $1,300,000. CD 2-25-55.

▲ N. Y., Fresh Meadows—SCHOOL—Bureau constr., Bd. Educ., 42-15 Crescent St., Long Island City, Zone 1, plans by Eggers & Higgins, 100 E. 42 St., New York, Zone 17, Proj. E-746, Northeast Queens High School, vicinity of 59 Ave. and Utopia Parkway, $7,385,000. To go ahead in 1957. CD 2-16-55.

▲ N. Y., New York—TECHNOLOGY—Bd. Higher Educ., Brett Hall, 13th St. and Convent Ave., Zone 31, plans by Lorimer & Rose, 254 W. 54 St., New York, Zone 19, Proj. HN-109, technology bldg. at City College, Uptown, $8,000,000. To go ahead in 1958. CD 4-20-55.

▲ N. Y., New York—SANITATION CENTER—Dpt. P. Wks., Municipal Bldg., Zone 7, S-144, Harlem Sanitation Center, incl. garage for Districts 9, 10 and 12 and incinerator, $11,500,000. To go ahead in 1958. CD 2-15-55.

▲ N. Y., New York—STATION HOUSE—Dpt. P. Wks., Municipal Bldg., Zone 7, PO-48, bids to replace Fifth and Seventh Precinct station house, vicinity of Division and Allen Sts., $1,245,000. To go ahead in 1958-1959. CD 3-2-55.

▲ O., Athens—EDUCATION COLLEGE—State Dpt. P. Wks., State Office Bldg., Columbus, Education College at Ohio University, $1,000,000.

▲ Pa., Dallas—SCHOOL—Dallas Area School Auth., School Bldg., high school, $1,000,000. Lacy, Atherton & Davis, Sterling Hotel, Wilkes-Barre, consult. engr.

▲ Pa., Phila.—SCHOOL—Bd. Educ., 21 and Winter Sts., plans by Paul Heron, Fox Bldg., elementary school, 18 St. and Snyder Ave., $1,000,000. McCormick-Taylor Assocs., 123 S. Broad St., engrs., Bell Tel. Bldg., CD 7-19-56.

▲ Pa., York—SCHOOL—Eastern Joint School Dist., Wrightsville, R. D., Junior-Senior High School, $2,000,000.

▲ R. I., Kingston—INDUSTRIAL—State R. I. & Prov. Plants, Div. Purchase, State House, Providence, plans by J. F. Hogan, 185 Westminster St., Providence, two new industrial bldgs., Dpt. Mechanical & Electrical Engineering, University of Rhode Island, $1,000,000. 1957 Constr. CD 11-19.

▲ Tex., Houston—MENTAL INSTITUTION—Bd. for Texas State Hospitals & Special Schools, 4405 Lamar Blvd., Austin, 500-bed mental institution, $5,000,000. Walter P. Moore, c/o owner, consult. engr.

▲ Tex., Terrell—WARDS, etc.—Bd. for Texas State Hospitals & Special Schools, 4405 Lamar Blvd., Austin, two ward bldgs., two new bldgs. for patients, occupational therapy bldg., sewer sys. for Terrell State Hospital, $1,214,490. Walter P. Moore, c/o owner, supv. engr. CD 11-28-55.

▲ Wash., Pullman—CHEMISTRY, etc.—Washington State College, Pullman, 4 story, 66,000 sq. ft. bldg. for chemistry and agricultural chemistry, $2,019,650; 4-story, 60,000 sq. ft. engineering bldg., $1,826,290; 4 story addn. to technology bldg., $785,000; 2 story, 20,000 sq. ft. ROTC bldg., $800,000; incinerator bldg., $150,000; replace oil pipe in water distr. sys., $250,000. Bids in 1957. CD 7-28-54.

▲ Wash., Pullman—PLANT SCIENCES—Washington State College, Pullman, plans by Naramore, Bain, Brady & Johnston, Smith Tower, Seattle, associated with Helms & Jones, Republic Bldg., Seattle, Zone 1, 4 story, 166,600 sq. ft. plant sciences bldg., $3,351,675. Bids in 1957. CD 8-15-48.

▲ Wash., Pullman—VETERINARY CLINIC—Washington State College, Pullman, plans by Cutler, Gale, Merrill & Norvell, Realty Bldg., Spokane, and Decker, Cline, Lamon & Kitchin, 1411 Fourth Ave. Bldg., Seattle, Zone 1, 2 story, 92,100 sq. ft. veterinary clinic, $1,316,750. Bids in 1957. CD 6-15-55.

▲ Wyo., Cheyenne—TRAINING SCHOOL—State Building Bd., Cheyenne, State Training School, office bldg. with apartments for professional help, dormitory to house 85 girls, addn. to hospital, two staff cottages and several monitor bldgs., $1,000,000; mgr. bldg., $665,000. University of Wyoming.

▲ Alta., Edmonton—NURSES' RESIDENCE, etc.—Royal Alexandra Hospital, Bd. Edmonton Nurses' residence and training school, 111 Ave. directly across from hospital, $2,700,000. To go ahead in the Summer or Fall of 1957. CD 1-9-54.

COMMERCIAL BUILDINGS

▲ Calif., Lancaster—DWELLINGS—Mona Building Corp., 227 S. Robertson St., Beverly Hills, plans by Arthur Rosenthal, 247 S. Spring St., Los Angeles, 1,121 ft. of Division, 2½ acres, $10,000,000.

▲ Calif., Monterey—SHOPPING CENTER—Del Monte Properties Co., 17 Mile Dr., Pebble Beach, shopping center and hotel on tract between Cannel Hill and Fremont Ave., $1,500,000.

▲ Calif., San Mateo—APARTMENT—John D. Swarts, 1415 S. Norfolk, Inglewood, 417 Ocean St., San Francisco, 81-unit apartment, incl. roof garden, swimming pool, $2,000,000.

(Continued on page 248)

CONTRACTORS

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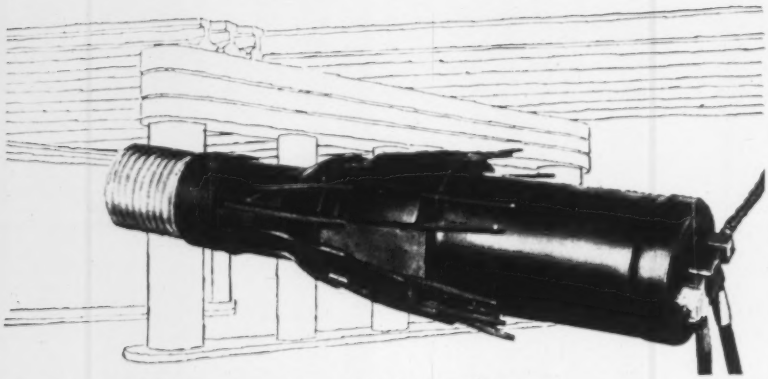

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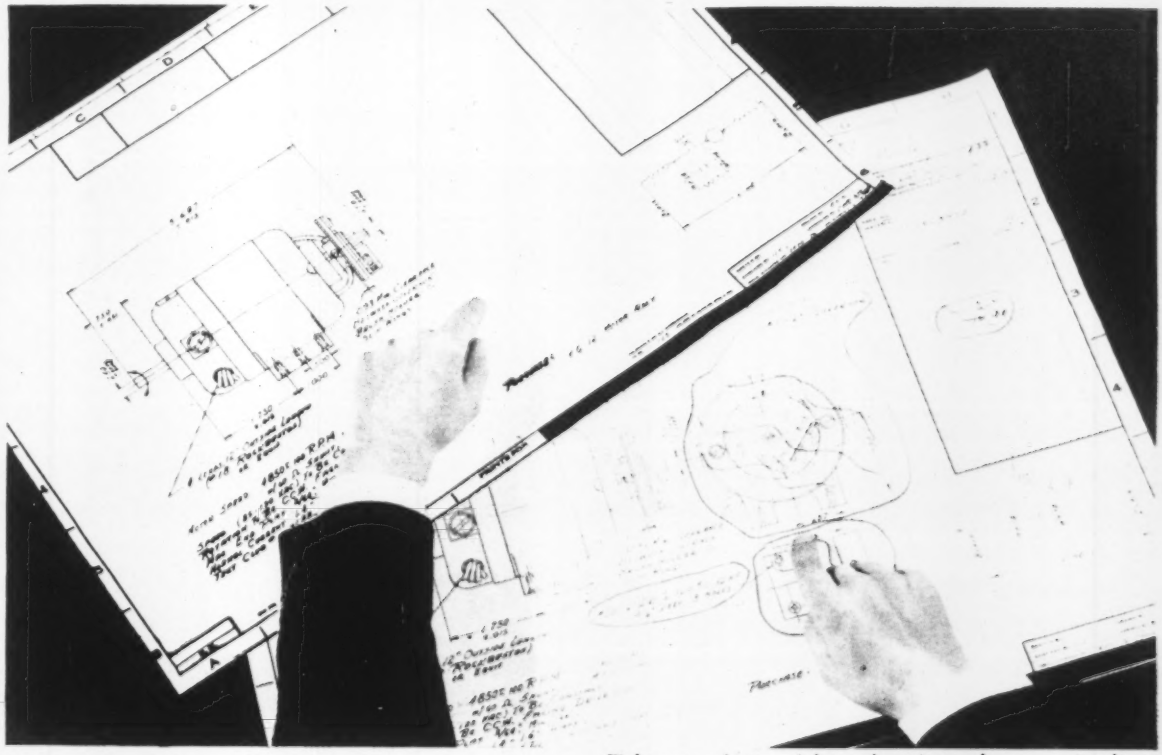

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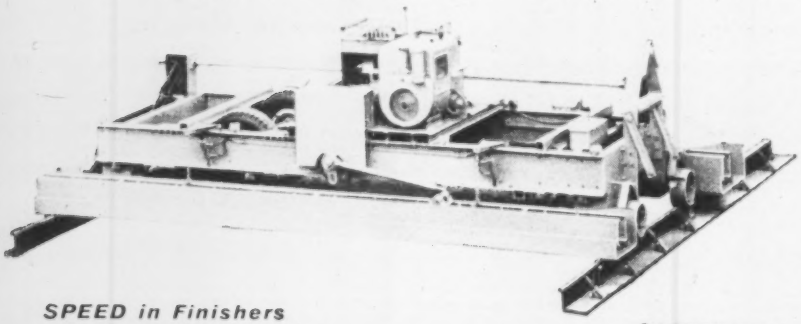

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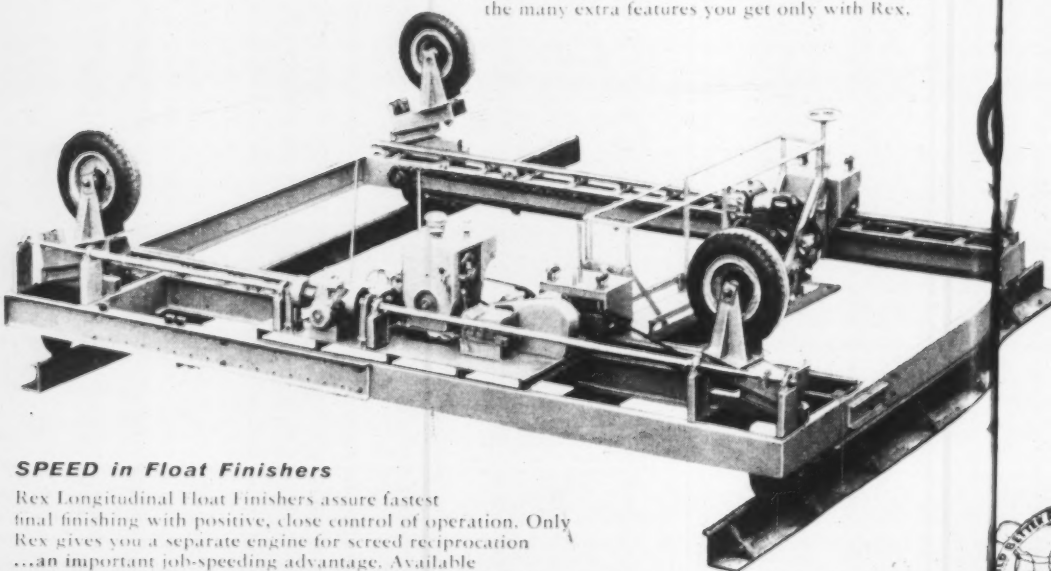

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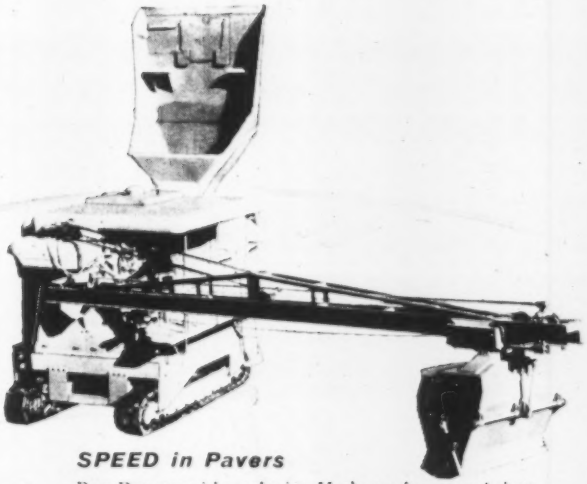

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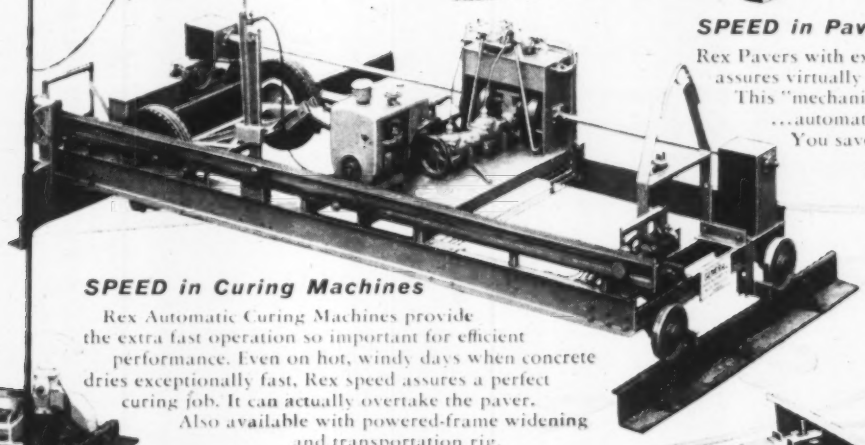

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Rex Automatic Curing Machines provide the extra fast operation so important for efficient performance. Even on hot, windy days when concrete dries exceptionally fast, Rex speed assures a perfect curing job. It can actually overtake the paver. Also available with powered-frame widening and transportation rig.

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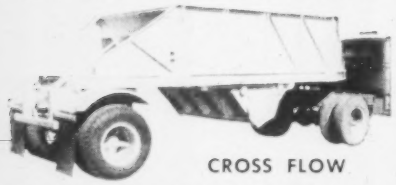
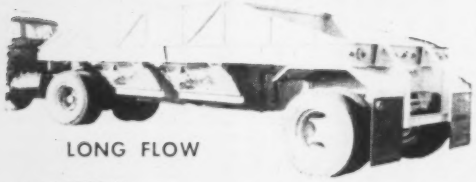


CROSS FLOW



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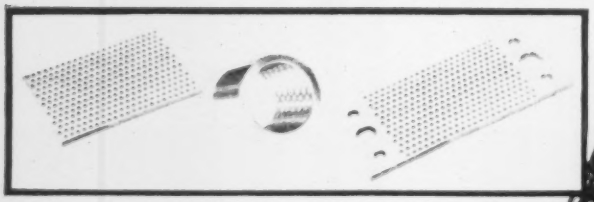

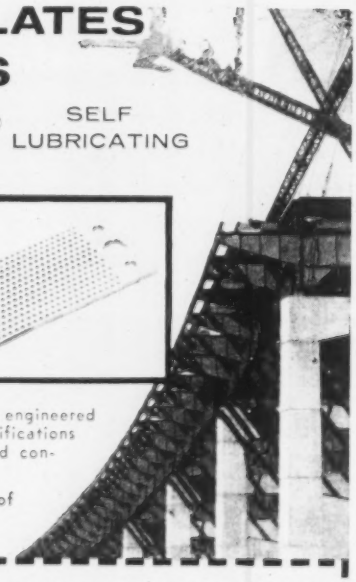

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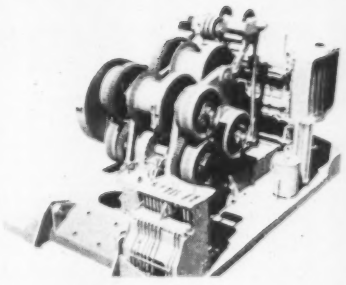

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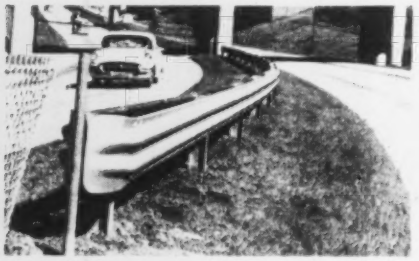

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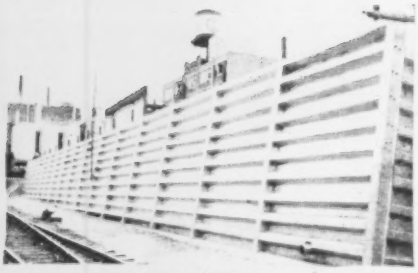

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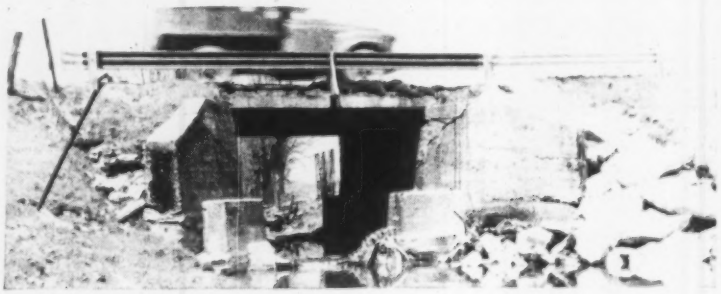

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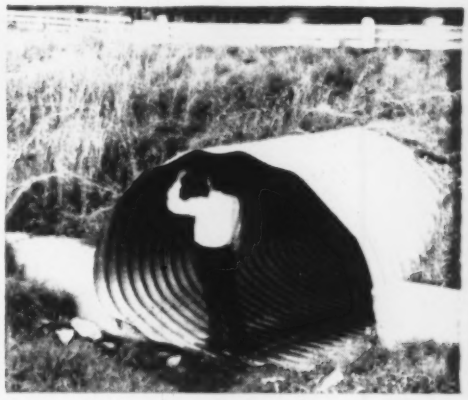
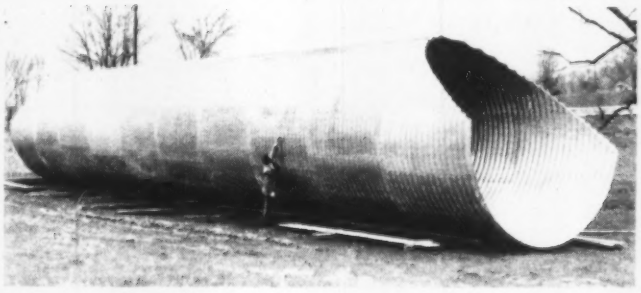


HERE IS ONE METHOD of bridge replacement that is often used where detours are not practical. The old structure remains in service while the Armco Structure is installed. In this case, the Pipe-Arch shape was specified to meet the low headroom requirement. Backfilling with earth makes it just like building the new pavement on solid ground. There is no worry about load limitations and practically nothing to maintain.



ARMCO MULTI-PLATE® PIPE was assembled at the site from curved, corrugated plates. Note how ends are beveled to fit the proposed slope of the completed earth fill.

AFTER THE OLD STRUCTURE was removed, the streambed was leveled and the Armco Structure pulled into place. Backfilling followed immediately. Result: a safe, strong structure.

RIGHT

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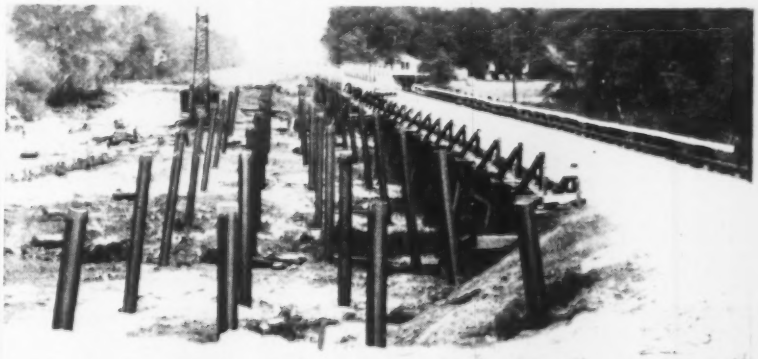
PROBABLY NO TWO bridge foundation problems are exactly alike. Yet there is a size and type of Armco Foundation Pipe to meet your varied needs. Picture shows Armco Pipe Piles used in pile bent construction on a bridge in Georgia. Narrow, outdated structure is at the right.



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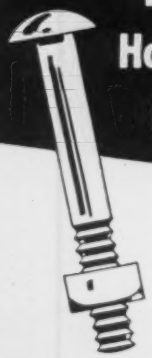

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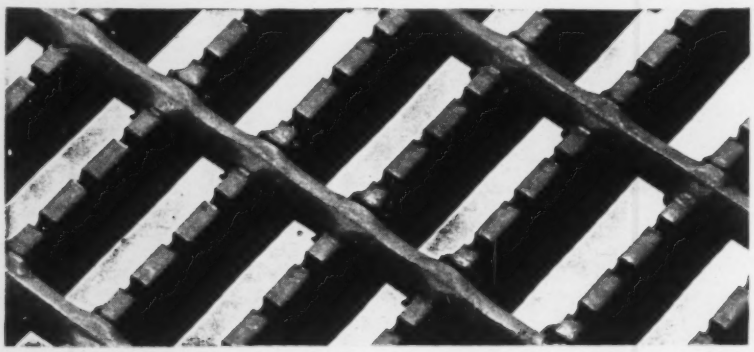
Plant and Main Office: 9 Lister Avenue, Newark 5, New Jersey

Direct lines: New Jersey MArket 3-0333 New York REctor 2-3958

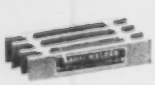


New Slip-Proof Design makes

Gary **SERRATED GRATING safest**

WHERE GOOD TRACTION IS IMPORTANT

Indoors or out, for area gratings in sidewalks, inclined walkways, fire escapes—wherever safe-footing is important, this one-piece, resistance-welded grating will provide safer working conditions. It's tailor-made to your requirements. Write for descriptive Catalog E-17.



FREE SAMPLE

We'll send this handy paper weight if you request it on your company stationery.

Standard Steel Spring Division

ROCKWELL SPRING AND AXLE CO.

4004 East Seventh Avenue • Gary, Indiana

(Continued from page 248)

N. J., Newark—$5,000,000.

▲ N. Y., Cheektowaga—BUILDING. [illegible] $3,000,000.

▲ N. C., Farmville—PLANT [illegible] $2,000,000.

▲ O., Wadsworth—PLANT [illegible] $1,000,000.

▲ Pa., North Wales—FOUNDRY AND [illegible] $1,225,000.

▲ Tex., Houston—POWER PLANT [illegible] $15,000,000. [illegible] $8,500,000. CD 1-28-57.

▲ Tex., Houston—PLANT, etc. [illegible] $1,000,000.

▲ W. Va., Nitro—PLANT [illegible] $4,000,000.

▲ Man., Portage LaPrairie—PLANT [illegible] $2,000,000.

UNCLASSIFIED

▲ Alabama—RURAL DISTRIBUTION [illegible] $4,693,000.

▲ California [illegible] $1,200,000.

▲ Calif., Hollywood—TELEVISION [illegible] $11,000,000.

▲† N. J., Whippany—NUCLEAR REACTOR [illegible] $2,000,000.

▲ New Mexico-Arizona-Utah—GAS PIPE LINE. Texas-New Mexico Pipe Line Co., [illegible] Houston, Tex., [illegible] to cover the border line to Bluff, Utah. $63,500,000.

▲ N. Y., New York—PIER. Dpt. Marine & Aviation, Pier A, North River, Zone 1, Proj. No. D-208, Pier 75, North River, $14,500,000. Roberts & Schaefer Co., 294 W. 54 St., New York, Zone 19, consult engrs. To go ahead in 1957, 1958, 1959. CD 9-9-55.

▲ Pennsylvania—GAS PIPE LINE—Cape Pipe Line Co. (Sun Pipe Line Co., Empire Gas & Fuel Co., sub. of Cities Service Co. and Atlantic Pipe Line Co., 1608 Walnut St., Phila., Zone 3, crude oil pipe line from Delaware Bay to Phila. refineries, including mainhead 4 mi. off shore, tank storage. To exceed $3,000,000. To go ahead in 1960.

▲† Wash., Bremerton—DRY DOCK—Pub. Wks. Officer, 13th Naval Dist. U. S. Naval Station, Seattle, new dry dock, $43,500,000. Moran, Proctor, Mueser & Rutledge, 420 Lexington Ave., New York, N. Y. and Carey & Kramer, 1917 1 Ave., Seattle, Zone 1, consult engrs. CD 11-30-55.

▲ West Virginia—TRANSMISSION LINES, DISTRIBUTION FACILITIES. Monongahela Power Co., Watson Bldg., Fairmont.

power transmission line from Riverside to [illegible] Island power station, $2,400,000.

1st section 132-kv. line from Riverside to [illegible] Fairview, $626,000.

132 kv. line from Willow Island to Tennant substation, $829,000.

sub-station at Sabraton, near Morgantown, $829,000.

converting Terra-Alta-Oakland line to 66 kv., $74,500.

converting Edgelawn-Lanestine Line to 66 kv., $310,000.

coal docks at Willow Island Station, $275,000.

66 kv. line to Dailey, Elkins Div., $140,000. To go ahead in 1957.

132 kv. line from Fairview to Willow Island, $1,790,000.

66 kv. line in Elkins Div. in Greenbrier, Pocahontas and Pendleton, $565,000.

transmission line from Weirton to New Cumberland to Arrays, $300,000.

22 kv. line from Glen Falls (Consolidation Coal Co.) Compass Coal Mine at Dora, $143,000.

line to Grantsville, Marion Co., $80,000.

66 kv. line to Middle Creek area, Preston Co., $98,000. To go ahead 1958.

66 kv. line from Sutton-[illegible] Area, [illegible] and Centerville Sections, $500,000.

transmission line to Sistersville, $117,000.

transmission line to Benson and [illegible] $320,000.

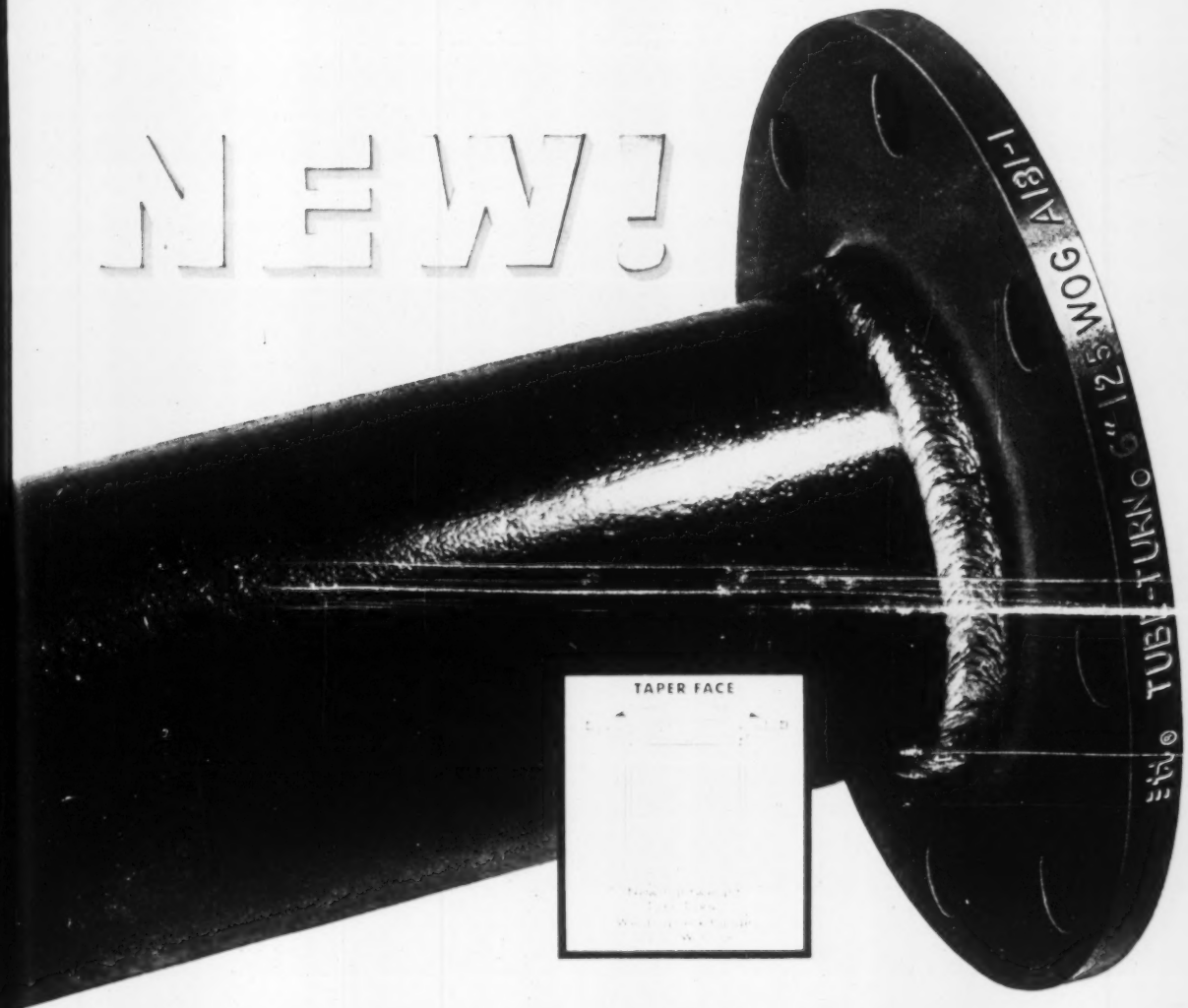
[illegible] from Morgantown to Fairmont Area, $182,000.

[illegible] $182,000.

[illegible] at Clarksburg, $375,000.

[illegible] at Lough's Run, Elkins, $283,000. To go ahead 1959.

NEW!



TUBE-TURN "TAPER FACE" FLANGE

...cuts cost of light-duty piping

...protects low pressure pumps and valves

Tube Turns announces a new lightweight welding neck flange for service up to 125 lbs. W.O.G. pressure, offering two important cost-cutting advantages: (1) It is priced lower than conventional flanges. (2) This lightweight welding neck flange has a tapered face which affords an effective seal with reduced bolt loading; hence, permits use of steel butt welding neck flanges without danger of cracking the flat faced cast iron flanges of valves and pumps used in low pressure piping systems. Here is another result of Tube Turns pioneering research, and an example of how you get *more for your money* when you specify TUBE-TURN Welding Fittings and Flanges and buy them from your nearby Tube Turns Distributor.

tt
TUBE-TURN
TRADE MARKS

* TUBE-TURN and "tt" Reg. U.S. Pat. Off.

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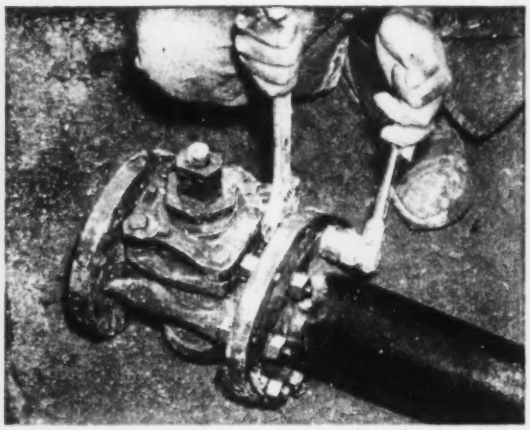
HOW TO SAVE

How you cut costs with TUBE-TURN FLANGES

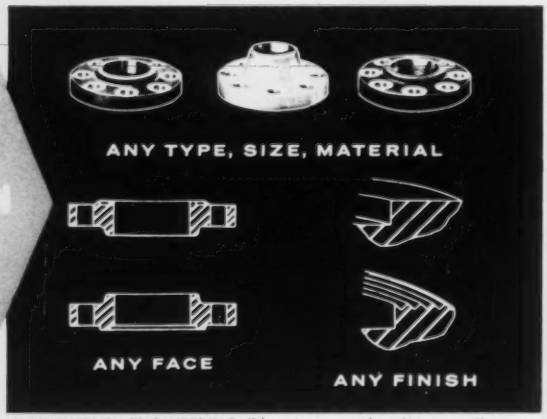
with the NEW Taper Face Flanges

CUTS FLANGE COSTS. For many applications of light-duty piping . . . up to 125 lb W.O.G. pressure . . . the new TUBE-TURN Taper Face Flange gives rated performance at a lower price than conventional designs. Here's a good teammate for lightweight pipe and fittings in applications such as water, oil and gas distribution . . . on pumps and compressors . . . any installation where welded piping must be flanged to low pressure valves, pumps or equipment.



PROTECTS VALVES AND PUMPS. Lightweight and tapered face permit good seals with reduced bolt-loading on valve or pump flanges. Lighter, lower-priced valves can be used without danger of cracking their flat faced cast iron flanges. Also, lighter neck of flange speeds up welding to pipe.

with all TUBE-TURN Flanges



YOU SIMPLIFY ENGINEERING. There's a complete line . . . all types, sizes, capacities, materials. You can specify TUBE-TURN Flanges and know you'll get the exact answer to your problem. Also, Tube Turns offers you engineering help.

YOU STREAMLINE PURCHASING. Your nearby Tube Turns Distributor provides complete-line service. This one source for all your needs in welding fittings and flanges enables you to put *all* your requirements on *one* order . . . to cut red tape, save valuable time.

MAIL FOR BOOKLET

The New line of Taper Face Flanges is described in this Tube Turns booklet . . . free on request.

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Please send free Bulletin on Taper Face Flanges.

Company Name

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New York · Philadelphia · Pittsburgh · Cleveland · Detroit
Chicago · Kansas City · Denver · Los Angeles · San Francisco
Seattle · Atlanta · Tulsa · Houston · Dallas · Midland, Texas

NEW ENGLAND

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS

BRIDGES

February 4 Connecticut

STREETS AND ROADS

January 29 Massachusetts February 4 Connecticut

BUILDINGS—BA

▲ Mass. Shrewsbury

HEAVY CONSTRUCTION—LB & CA

▲ MASSACHUSETTS

Coleman Bros. Corp. $6,198,813

BUILDINGS—LB & CA

▲ Lilly Constr. Co. $2,000,000

▲ Kay-Vee Homes, Inc. $1,300,000

MIDDLE ATLANTIC

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS

STREETS AND ROADS

February 6 Delaware February 8 Pennsylvania

▲† Md. Annapolis

HEAVY CONSTRUCTION—LB & CA

▲ Brookfield Constr. Co. $9,613,003

▲ McKeesport-Terry Corp. A $2,253,100

▲ Joseph Meltzer Associates, Inc. and Rudolf Bros., Inc. A $4,245,936

▲ PENNSYLVANIA

F. D. Kreider, Inc. Ex. CA $2,771,557

Ex. Edward A. Davis Co., Inc. A $591,134

BUILDINGS—LB & CA

▲ Kretzer Constr. Co. $2,000,000

▲† Mars Constr. Corp. A $2,852,000

▲ Benjamin Brasman

▲ Constanza Constr. Co. $1,923,000

▲ H. K. Ferguson Co. $5,000,000

SOUTH

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS

BRIDGES

January 30 Louisiana

STREETS AND ROADS

January 30 Louisiana

▲† La. New Iberia

HEAVY CONSTRUCTION—LB & CA

▲ MacDonald Constr. Co. $2,097,322

BUILDINGS—LB & CA

▲ Thomp-on-Street Contractors $7,520,000

▲ R. F. Ball Constr. Co. $6,279,784 $7,120,540

▲ Daniel Constr. Co., Inc. $3,591,600

Prevents Cracks.. Preserves Beauty

Trussed Design

Butt Weld • Deformed Rods

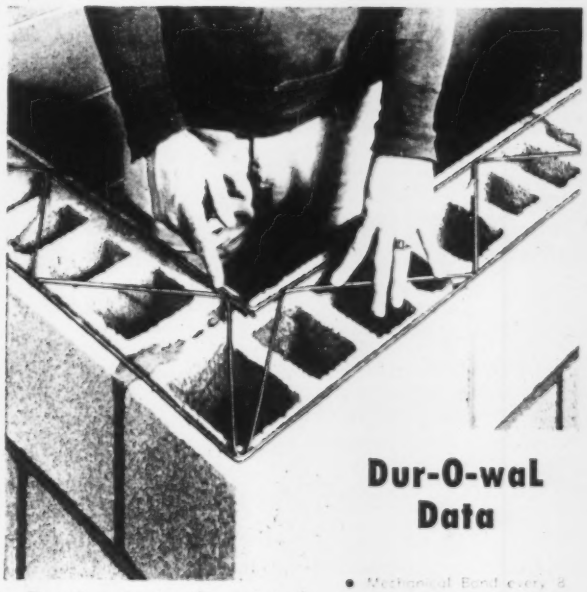
DUR-O-WAL®

the Backbone of Steel for EVERY masonry wall

Call, wire or write Dept. 2N today, for complete information on Dur-O-wal. Literature available with research data from independent tests.

See our catalog in Sweet's or write for copy

Dur-O-wal Div., Cedar Rapids Block Co., **CEDAR RAPIDS, IA.** Dur-O-wal Prod., Inc., Box 628, **SYRACUSE, N.Y.** Dur-O-wal of Ill., 119 N. River St., **AURORA, ILL.** Dur-O-wal Prod. of Ala., Inc., Box 5446, **BIRMINGHAM, ALA.** Dur-O-wal Prod., Inc., 4500 E. Lombard St., **BALTIMORE, MD.** Dur-O-wal Div., Frontier Mfg. Co., Box 49, **PHOENIX, ARIZ.** Dur-O-wal, Inc., 165 Utah St., **TOLEDO, OHIO**

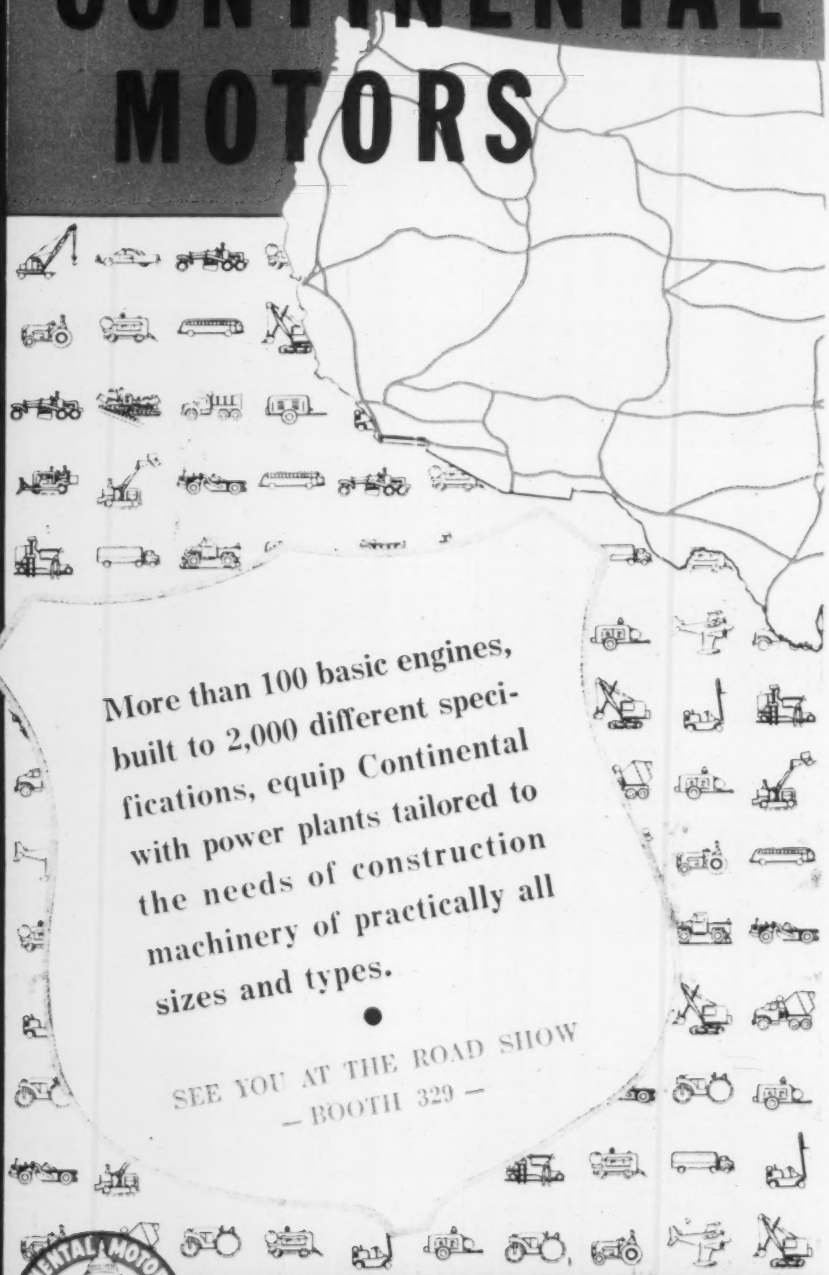


Dur-O-waL is the original steel reinforcing member designed to combat cracking of masonry walls. To add structural soundness and to preserve the beauty in the buildings you design, specify Dur-O-waL. It lays flat in the mortar bed . . . handles fast . . . provides crack control for every type of masonry wall.

Dur-O-waL Data

• Mechanical Bond every 8 inches of wall • **High Tensile Steel** (conforms to ASTM Standard A-82-34) • **Double Mortar Lock** at each weld • **Electric Butt Welds** place all rods on a single plane • **Deformed Side Rods** lay straight and flat due to hardness of steel • **Trussed Design** causes side rods to work together.

NOW! ...from CONTINENTAL MOTORS



More than 100 basic engines, built to 2,000 different specifications, equip Continental with power plants tailored to the needs of construction machinery of practically all sizes and types.

SEE YOU AT THE ROAD SHOW
— BOOTH 329 —

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD

*TM REG.

Continental Motors Corporation

205 MARKET STREET • MUSKEGON, MICHIGAN

BLDG., Mobile, ALA. Mobile Co. Bd. Revenue, Courthouse, Mobile, Ala. Awarded Jan. 14. CD 1-14. Lump sum LB.

MIDDLE WEST

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS

BRIDGES
February 6 Michigan

STREETS AND ROADS
February 6 Michigan

▲ O., Hamilton—BA 2-28. City of, Pre-C Highway Permits, Zoning, City Engr. Lets Hamilton Dr. Plant treatment expand, $1,500,000. Plans prepared by Howard, Needles, Tammen & Bergendoff, New York. Expand Aer Rotation 11, 12, contract empl. CD 1-11.

HEAVY CONSTRUCTION—LB & CA

▲ Garwick & Ross, Inc., 990 W. 1 Ave., Columbus, O. CA $2,227,000, general constr. sewerage, including 2 P Columbus, Ohio. Grand total $4,294,016. City Hall, Columbus, O. Bids Dec. 11. CD 12-19. Under LB.

Limbach Co., 851 Williams Rd., Columbus, O. CA $343,710, heating and air conditioning. CA $165,924. Plumbing, Port Columbus, Columbus, O.

Gustav Hirsch Organization, Inc., 1337 W. Fifth Ave., Columbus, O. CA $557,400, electrical work, Port Columbus, Columbus, O.

▲ ILLINOIS Illinois Toll Highway Comm., 2 N. Wacker Dr., Chicago.

Arcole Midwest Corp., 3225 Mile St., Skokie, Ill. LB $7,312,189. (8 bidders). Sections, Kmet and Rte. grading, drainage, paving, constr. appurtenances, 2 Fork Interstate bridges, 4.43 mile east of Rockford Rd. to W. Roselle Rd. and Contr. Sect. grading, drainage, paving, constr. appurtenances, precast concrete beam, 4.38 mi. west of Roselle Rd. extend eastward to 1.1 mi. south of Golf Road, Cook Co. Bids Jan. 11. CD 12-28.

▲ ILLINOIS Illinois Toll Hy. Comm., Sherman Hotel, Chicago.

W. E. O'Neil Constr. Co., and Winkelman Constr. Co., 2752 Cullerton Av., Chicago, Ill. LB $5,454,553, roadway constr. Sect. 7m-A, 8m-A, 8m-B, 8m-C, 8m-D, 8m-E, 8m-F, 8m-G, 8m-H, 8m-I, 8m-J, 8m-K, 8m-L, 8m-M, 8m-N, 8m-O, 8m-P, 8m-Q, 8m-R, 8m-S, 8m-T, 8m-U, 8m-V, 8m-W, 8m-X, 8m-Y, 8m-Z, 8m-AA, 8m-AB, 8m-AC, 8m-AD, 8m-AE, 8m-AF, 8m-AG, 8m-AH, 8m-AI, 8m-AJ, 8m-AK, 8m-AL, 8m-AM, 8m-AN, 8m-AO, 8m-AP, 8m-AQ, 8m-AR, 8m-AS, 8m-AT, 8m-AU, 8m-AV, 8m-AW, 8m-AX, 8m-AY, 8m-AZ, 8m-BA, 8m-BB, 8m-BC, 8m-BD, 8m-BE, 8m-BF, 8m-BG, 8m-BH, 8m-BI, 8m-BJ, 8m-BK, 8m-BL, 8m-BM, 8m-BN, 8m-BO, 8m-BP, 8m-BQ, 8m-BR, 8m-BS, 8m-BT, 8m-BU, 8m-BV, 8m-BW, 8m-BX, 8m-BY, 8m-BZ, 8m-CA, 8m-CB, 8m-CC, 8m-CD, 8m-CE, 8m-CF, 8m-CG, 8m-CH, 8m-CI, 8m-CJ, 8m-CK, 8m-CL, 8m-CM, 8m-CN, 8m-CO, 8m-CP, 8m-CQ, 8m-CR, 8m-CS, 8m-CT, 8m-CU, 8m-CV, 8m-CW, 8m-CX, 8m-CY, 8m-CZ, 8m-DA, 8m-DB, 8m-DC, 8m-DD, 8m-DE, 8m-DF, 8m-DG, 8m-DH, 8m-DI, 8m-DJ, 8m-DK, 8m-DL, 8m-DM, 8m-DN, 8m-DO, 8m-DP, 8m-DQ, 8m-DR, 8m-DS, 8m-DT, 8m-DU, 8m-DV, 8m-DW, 8m-DX, 8m-DY, 8m-DZ, 8m-EA, 8m-EB, 8m-EC, 8m-ED, 8m-EE, 8m-EF, 8m-EG, 8m-EH, 8m-EI, 8m-EJ, 8m-EK, 8m-EL, 8m-EM, 8m-EN, 8m-EO, 8m-EP, 8m-EQ, 8m-ER, 8m-ES, 8m-ET, 8m-EU, 8m-EV, 8m-EW, 8m-EX, 8m-EY, 8m-EZ, 8m-FA, 8m-FB, 8m-FC, 8m-FD, 8m-FE, 8m-FF, 8m-FG, 8m-FH, 8m-FI, 8m-FJ, 8m-FK, 8m-FL, 8m-FM, 8m-FN, 8m-FO, 8m-FP, 8m-FQ, 8m-FR, 8m-FS, 8m-FT, 8m-FU, 8m-FV, 8m-FW, 8m-FX, 8m-FY, 8m-FZ, 8m-GA, 8m-GB, 8m-GC, 8m-GD, 8m-GE, 8m-GF, 8m-GG, 8m-GH, 8m-GI, 8m-GJ, 8m-GK, 8m-GL, 8m-GM, 8m-GN, 8m-GO, 8m-GP, 8m-GQ, 8m-GR, 8m-GS, 8m-GT, 8m-GU, 8m-GV, 8m-GW, 8m-GX, 8m-GY, 8m-GZ, 8m-HA, 8m-HB, 8m-HC, 8m-HD, 8m-HE, 8m-HF, 8m-HG, 8m-HH, 8m-HI, 8m-HJ, 8m-HK, 8m-HL, 8m-HM, 8m-HN, 8m-HO, 8m-HP, 8m-HQ, 8m-HR, 8m-HS, 8m-HT, 8m-HU, 8m-HV, 8m-HW, 8m-HX, 8m-HY, 8m-HZ, 8m-IA, 8m-IB, 8m-IC, 8m-ID, 8m-IE, 8m-IF, 8m-IG, 8m-IH, 8m-II, 8m-IJ, 8m-IK, 8m-IL, 8m-IM, 8m-IN, 8m-IO, 8m-IP, 8m-IQ, 8m-IR, 8m-IS, 8m-IT, 8m-IU, 8m-IV, 8m-IW, 8m-IX, 8m-IY, 8m-IZ, 8m-JA, 8m-JB, 8m-JC, 8m-JD, 8m-JE, 8m-JF, 8m-JG, 8m-JH, 8m-JI, 8m-JJ, 8m-JK, 8m-JL, 8m-JM, 8m-JN, 8m-JO, 8m-JP, 8m-JQ, 8m-JR, 8m-JS, 8m-JT, 8m-JU, 8m-JV, 8m-JW, 8m-JX, 8m-JY, 8m-JZ, 8m-KA, 8m-KB, 8m-KC, 8m-KD, 8m-KE, 8m-KF, 8m-KG, 8m-KH, 8m-KI, 8m-KJ, 8m-KK, 8m-KL, 8m-KM, 8m-KN, 8m-KO, 8m-KP, 8m-KQ, 8m-KR, 8m-KS, 8m-KT, 8m-KU, 8m-KV, 8m-KW, 8m-KX, 8m-KY, 8m-KZ, 8m-LA, 8m-LB, 8m-LC, 8m-LD, 8m-LE, 8m-LF, 8m-LG, 8m-LH, 8m-LI, 8m-LJ, 8m-LK, 8m-LL, 8m-LM, 8m-LN, 8m-LO, 8m-LP, 8m-LQ, 8m-LR, 8m-LS, 8m-LT, 8m-LU, 8m-LV, 8m-LW, 8m-LX, 8m-LY, 8m-LZ, 8m-MA, 8m-MB, 8m-MC, 8m-MD, 8m-ME, 8m-MF, 8m-MG, 8m-MH, 8m-MI, 8m-MJ, 8m-MK, 8m-ML, 8m-MM, 8m-MN, 8m-MO, 8m-MP, 8m-MQ, 8m-MR, 8m-MS, 8m-MT, 8m-MU, 8m-MV, 8m-MW, 8m-MX, 8m-MY, 8m-MZ, 8m-NA, 8m-NB, 8m-NC, 8m-ND, 8m-NE, 8m-NF, 8m-NG, 8m-NH, 8m-NI, 8m-NJ, 8m-NK, 8m-NL, 8m-NM, 8m-NN, 8m-NO, 8m-NP, 8m-NQ, 8m-NR, 8m-NS, 8m-NT, 8m-NU, 8m-NV, 8m-NW, 8m-NX, 8m-NY, 8m-NZ, 8m-OA, 8m-OB, 8m-OC, 8m-OD, 8m-OE, 8m-OF, 8m-OG, 8m-OH, 8m-OI, 8m-OJ, 8m-OK, 8m-OL, 8m-OM, 8m-ON, 8m-OO, 8m-OP, 8m-OQ, 8m-OR, 8m-OS, 8m-OT, 8m-OU, 8m-OV, 8m-OW, 8m-OX, 8m-OY, 8m-OZ, 8m-PA, 8m-PB, 8m-PC, 8m-PD, 8m-PE, 8m-PF, 8m-PG, 8m-PH, 8m-PI, 8m-PJ, 8m-PK, 8m-PL, 8m-PM, 8m-PN, 8m-PO, 8m-PP, 8m-PQ, 8m-PR, 8m-PS, 8m-PT, 8m-PU, 8m-PV, 8m-PW, 8m-PX, 8m-PY, 8m-PZ, 8m-QA, 8m-QB, 8m-QC, 8m-QD, 8m-QE, 8m-QF, 8m-QG, 8m-QH, 8m-QI, 8m-QJ, 8m-QK, 8m-QL, 8m-QM, 8m-QN, 8m-QO, 8m-QP, 8m-QQ, 8m-QR, 8m-QS, 8m-QT, 8m-QU, 8m-QV, 8m-QW, 8m-QX, 8m-QY, 8m-QZ, 8m-RA, 8m-RB, 8m-RC, 8m-RD, 8m-RE, 8m-RF, 8m-RG, 8m-RH, 8m-RI, 8m-RJ, 8m-RK, 8m-RL, 8m-RM, 8m-RN, 8m-RO, 8m-RP, 8m-RQ, 8m-RR, 8m-RS, 8m-RT, 8m-RU, 8m-RV, 8m-RW, 8m-RX, 8m-RY, 8m-RZ, 8m-SA, 8m-SB, 8m-SC, 8m-SD, 8m-SE, 8m-SF, 8m-SG, 8m-SH, 8m-SI, 8m-SJ, 8m-SK, 8m-SL, 8m-SM, 8m-SN, 8m-SO, 8m-SP, 8m-SQ, 8m-SR, 8m-SS, 8m-ST, 8m-SU, 8m-SV, 8m-SW, 8m-SX, 8m-SY, 8m-SZ, 8m-TA, 8m-TB, 8m-TC, 8m-TD, 8m-TE, 8m-TF, 8m-TG, 8m-TH, 8m-TI, 8m-TJ, 8m-TK, 8m-TL, 8m-TM, 8m-TN, 8m-TO, 8m-TP, 8m-TQ, 8m-TR, 8m-TS, 8m-TT, 8m-TU, 8m-TV, 8m-TW, 8m-TX, 8m-TY, 8m-TZ, 8m-UA, 8m-UB, 8m-UC, 8m-UD, 8m-UE, 8m-UF, 8m-UG, 8m-UH, 8m-UI, 8m-UJ, 8m-UK, 8m-UL, 8m-UM, 8m-UN, 8m-UO, 8m-UP, 8m-UQ, 8m-UR, 8m-US, 8m-UT, 8m-UU, 8m-UV, 8m-UW, 8m-UX, 8m-UY, 8m-UZ, 8m-VA, 8m-VB, 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8m-BMZ, 8m-BNA, 8m-BNB, 8m-BNC, 8m-BND, 8m-BNE, 8m-BNF, 8m-BNG, 8m-BNH, 8m-BNI, 8m-BNJ, 8m-BNK, 8m-BNL, 8m-BNM, 8m-BNN, 8m-BNO, 8m-BNP, 8m-BNQ, 8m-BNR, 8m-BNS, 8m-BNT, 8m-BNU, 8m-BNV, 8m-BNW, 8m-BNX, 8m-BNY, 8m-BNZ, 8m-BOA, 8m-BOB, 8m-BOC, 8m-BOD, 8m-BOE, 8m-BOF, 8m-BOG, 8m-BOH, 8m-BOI, 8m-BOJ, 8m-BOK, 8m-BOL, 8m-BOM, 8m-BON, 8m-BOO, 8m-BOP, 8m-BOQ, 8m-BOR, 8m-BOS, 8m-BOT, 8m-BOU, 8m-BOV, 8m-BOW, 8m-BOX, 8m-BOY, 8m-BOZ, 8m-BPA, 8m-BPB, 8m-BPC, 8m-BPD, 8m-BPE, 8m-BPF, 8m-BPG, 8m-BPH, 8m-BPI, 8m-BPJ, 8m-BPK, 8m-BPL, 8m-BPM, 8m-BPN, 8m-BPO, 8m-BPP, 8m-BPQ, 8m-BPR, 8m-BPS, 8m-BPT, 8m-BPU, 8m-BPV, 8m-BPW, 8m-BPX, 8m-BPY, 8m-BPZ, 8m-BQA, 8m-BQB, 8m-BQC, 8m-BQD, 8m-BQE, 8m-BQF, 8m-BQG, 8m-BQH, 8m-BQI, 8m-BQJ, 8m-BQK, 8m-BQL, 8m-BQM, 8m-BQN, 8m-BQO, 8m-BQP, 8m-BQQ, 8m-BQR, 8m-BQS, 8m-BQT, 8m-BQU, 8m-BQV, 8m-BQW, 8m-BQX, 8m-BQY, 8m-BQZ, 8m-BRA, 8m-BRB, 8m-BRC, 8m-BRD, 8m-BRE, 8m-BRF, 8m-BRG, 8m-BRH, 8m-BRI, 8m-BRJ, 8m-BRK, 8m-BRL, 8m-BRM, 8m-BRN, 8m-BRO, 8m-BRP, 8m-BRQ, 8m-BRR, 8m-BRS, 8m-BRT, 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300 Broadway, Little Rock, Ark. Bids Jan. 15. CD 12/14.

▲ † Allis-Chalmers Mfg. Co., 1126 S. 70 St., Milwaukee, Wis., LB $10,282,740 (3 bidders) hydraulic turbines, Oahe Reservoir Proj., near Pierre, Inv. 25-060-57-29, SOUTH DAKOTA. U.S. Eng., 1709 Jackson Sts., Omaha, Neb. Bids Jan. 8. CD 12/6.

BUILDINGS—LB & CA

▲ Sebco, Inc., 126 Bryant Ave. N., Minneapolis, Minn., CA est. $4,500,000, design and construct OFFICE, incl. 15 to 20 separate bldgs., Bent Line and Wayzata Blvd., ST. LOUIS PARK, MINN. Alenbo, Inc., A. Svensson, pres., 127 Bryant Ave. N., Minneapolis, Minn. CD 4/12.

FAR WEST

HEAVY CONSTRUCTION—BA

▲ Calif., Los Angeles—BA 2/15—Los Angeles County Flood Control Dist., 2250 Alcazar St., Proj. No. 13, constr. Inglewood Ave., Century Blvd. storm sewers, $3,000,000. CD 11/7/52.

BUILDINGS—BA

▲ Calif., Stockton—HIGH SCHOOL—BA 2/15—Stockton City Unified School Dist., c/o Supt., 324 N. San Joaquin St., 1 story wood frame, with steel reinf. Alonzo Stagg High School, incl. swimming pool, $2,500,000. Plans deposit $50. John Carl Warnecke, 111 New Montgomery St., San Francisco, archt. CD 11/15/55.

BUILDINGS—SLC

▲ Calif., San Jose—PLANT—International Business Machine Co., 99 Notre Dame St., soon lets contract. IBM plant, Phase No. 2, $8,750,000. John Bolles, Pier 5, San Francisco, archt. CD 1/15.

HEAVY CONSTRUCTION—LB & CA

▲ † Lembke, Clough & King, Inc., 107 W. Wyoming Ave., Las Vegas, Nev., LB $1,999,955, est. $1,947,153 (10 bidders), Schedule C, four 2 story dormitories, 1 story masonry block dining hall and heating plant; 2 two story officers quarters, Stead Air Force Base, ENG-04-167-57-29, RENO, NEV. U.S. Eng., 1209 8th St., Sacramento, Calif. Bids Jan. 10. CD 12/14.

▲ CALIFORNIA State Dpt. P. Wks., 1120 N St., Sacramento.

A. Teichert & Son, Inc., 1931 Stockton Blvd., Sacramento, Calif., CA $1,987,320, constr. 1.8 mi. sect. Sacramento-Lodi Freeway, U.S. 99 between south of the Cosumnes River to 0.2 mi. south of Elk Grove Rd. and constr. railroad overhead, 2 overcrossings and 4 bridges, Sacramento Co. Bids Jan. 2, awarded Jan. 11. CD 1/4, under LB.

▲ R. V. Lloyd & Co., P. O. Box 128, Coachella, Calif., LB $7,272,396 (3 bidders). Spec. 509, constr. 54½ mi. siphons from town of Earp to town of Desert Hot Springs, San Bernardino and Riverside Counties, LOS ANGELES, CALIF. Metropolitan Water Dist. of Southern Calif., 303 W. 3 St., Los Angeles, Calif. Bids Jan. 16. CD 1/9.

BUILDINGS—LB & CA

▲ The Pacific Coast Builders, 1 South Park St., San Francisco, Calif., LB $1,756,250 (7 bidders) HIGH SCHOOL, bldgs., Woodside Rd. and Alameda de las Pulgas, REDWOOD CITY, CALIF. Sequoia Union High School Dist., Broadway, El Camino Real, Redwood City, Calif. Bids Jan. 8. CD 12/12.

CANADA

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS
BRIDGES
February 20, Nova Scotia

BUILDINGS—BA

▲ B. C., Coquitlam—PLANT—BA 1/28—Canadian Potteries Ltd., c/o 1500 Powell St., Vancouver, 1 story, 160,000 sq. ft. frame, steel joists, tile roof, vitreous china and vitrified plumbing fixtures, $2,500,000. Equipped. Thompson, Berwick & Pratt, 1551 Robson St., Vancouver, archts.

HEAVY CONSTRUCTION—LB & CA

▲ Dominion Bridge Co. Ltd., Lachine, Que. CA $2,503,218, superstructure, Pier 11 to 29, Hospice Macdonald Bridge extens., Lachine Sect. of Seaway, St. Lawrence Seaway, QUEBEC, St. Lawrence Seaway Auth., No. 2 Temporary Bldg., Ottawa, Ont. Bids Nov. 27, awarded Jan. 4. CD 12/3, under LB.

BUILDINGS—LB & CA

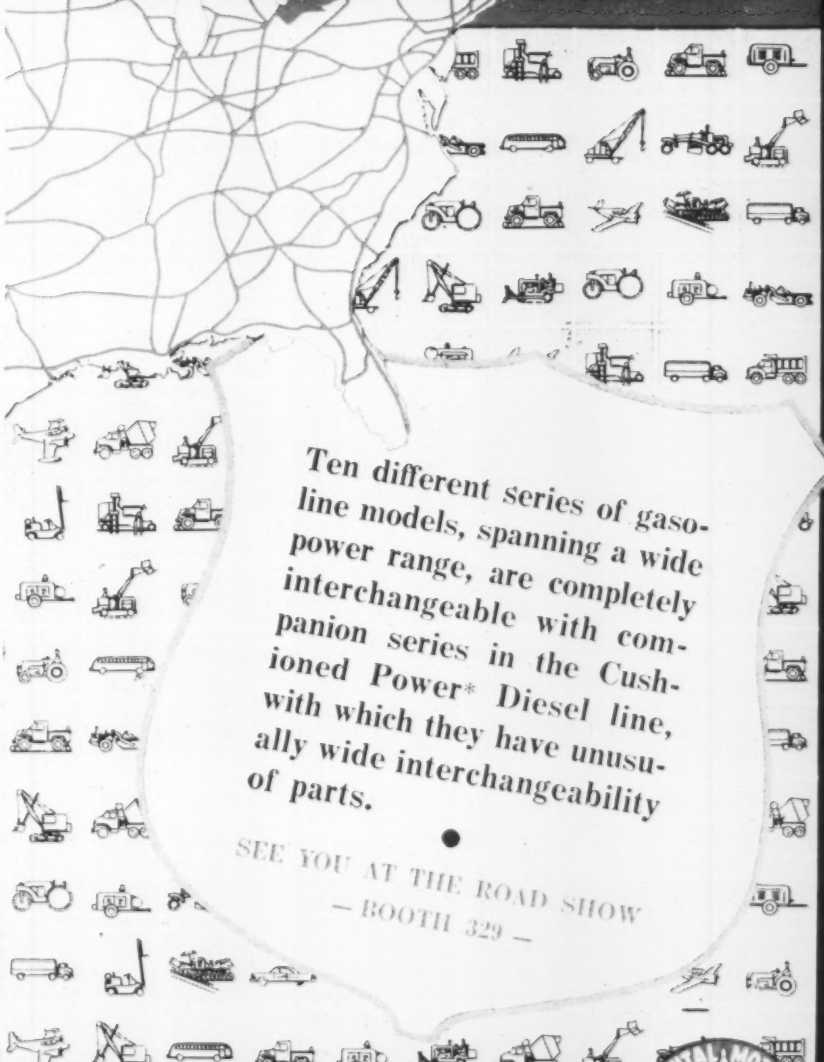
▲ Argo Constr. Ltd., 18 Gladstone Ave., Westmount, Montreal, Que., CA $3,344,000, 11 bidders, CUSTOMS BLDG., Duckworth and Water Sts., ST. JOHN'S, NEWFOUNDLAND. Dept. P. Wks., Hunter Bldg., Ottawa, Ont. Bids Nov. 14, awarded Jan. 4. CD 11/29, under LB.

▲ Foundation Co. of Canada, Ltd., 1220 Bay St., Toronto, Ont., CA est. $4,000,000, 9 story, basement, penthouses, 100x200 ft. steel frame, PLANT OFFICE, with addns. and alterations to present bldg., TORONTO, ONT. MacLean-Hunter Publishing Co. Ltd., 481 University Ave., Toronto, Ont. Bids Dec. 20, awarded Jan. 7. CD 12/3.

▲ E. G. M. Cape & Co. Ltd., 3898 Wellington Ave., Montreal, Que., CA $4,898,000, 11 bidders) combined CUSTOMS-IMMIGRATION BLDG., 3 story, 140x438 ft. main bldg., 125x165 ft. hall, incl. three wings, 40x100 ft., architectural reinforced frame constr., Wolfe's Cove, QUEBEC CITY, QUE. Dept. P. Wks., Hunter Bldg., Ottawa, Ont. Bids Dec. 5, awarded Jan. 4. CD 10/30.

(Proposal Advertisements see pp. 272 to 274)

MORE Power...
BETTER Power....
for Every Phase of the
BIG ROAD PROGRAM!



Ten different series of gasoline models, spanning a wide power range, are completely interchangeable with companion series in the Cushioned Power* Diesel line, with which they have unusually wide interchangeability of parts.

SEE YOU AT THE ROAD SHOW
— BOOTH 329 —

Continental Motors Corporation

205 MARKET STREET • MUSKEGON, MICHIGAN

CONTINENTAL MOTORS — Powerful as the Nation — AMERICA'S STANDARD

*TM REG.

27 Seaman-Andwall Trav-L-Plant Uniformity in AASHO Sub-Base

Global interest shown as AASHO sets construction pattern

Highway officials, engineers and contractors from all parts of the world have been watching the most rigidly controlled road construction experiment ever attempted. AASHO engineers demanded undeviating uniformity in the sub-base of every test section. All equipment had to prove its performance beyond question before acceptance. And all equipment had to be absolutely identical. After competitive test with other mixers, Seaman TRAV-L-PLANTS were selected to do the mixing, the blending of soil particles to attain the specified 95% densities and to bring the moisture content of the fill to optimum. 27 TRAV-L-PLANTS, all equipped with pumping equipment, volumetric meters, spray bars, underbody scarifiers and power steering kept the moisture increment within the tight 2% tolerance demanded.

The stiff clay used in the sub-base stabilization made the job of fast, uniform mixing impossible in the initial experiments made with other equipment. The SEAMAN-ANDWALL TRAV-L-PLANT, on the other hand, demonstrated great superiority in the attainment of the exacting uniformity.

Each TRAV-L-PLANT towed its own water supply because tank trucks were not allowed on grade. 1000 gallon wheel mounted tanks were attached

AASHO TESTS PATTERN FUTURE HIGHWAY METHODS

Sub-grade stabilization, once the most neglected phase of modern highway construction, has come of age. The most recent proof of this comes from LaSalle, Illinois, center of the most ambitious experimental highway construction programs in the nation's history. The American Association of State Highway Officials; all 48 states; the territories of Hawaii, Puerto Rico and the District of Columbia and the Highway Research Board are participating in the construction of this significant test facility. The AASHO test road will be in the nations road building spotlight for many years to come. The painstaking control exercised by AASHO engineers; the precision and perfection of new road building methods and the high speed equipment that was used, will certainly be studied and specified on many thousands of miles of new construction. The techniques and operations adopted at the AASHO test road may well become standard operating procedure on all roads of the future.

SEE THE ROAD SHOW

BE SURE TO SEE THE SEAMAN-ANDWALL EXHIBIT AT THE ROAD SHOW, SECTION A, BOOTHS 320 AND 323

S-A

chieve Unparalleled
tabilization Tests

nation's highway program

t the side of the TRAV-L-PLANTS by an out-igger device.

EAMAN-ANDWALL TRAV-L-PLANTS through heir superiority established in the gigantic AASHO xperiment have again won recognition and ap-roval as standard equipment in base and sub-base tabilization in the National Highway Program.

uccessful bidders for the sub-grade work were he S. J. Groves and Sons, Co. of Minneapolis and he Arcole Midwest Construction Co. of Skokie, llinois.

A caravan of four TRAV-L-PLANTS on the straightaway of the AASHO test road. It is high production like this that completes the sub-base stabilization work on time. A total of 27 such units were on the job.

The Seaman-Andwall TRAV-L-PLANT with special outrigger water supply tank on a super-elevated "turn-around" of the AASHO test road. Note the out-rigger wheel and novel hitch arrangement. No standard water trucks were permitted on the grade.

Under-body scarifier of the TRAV-L-PLANT makes secondary scarification an easy task in the cloddy clay soils of central Illinois. The scarifier is standard equipment on this machine.

Here is a new complete-line Bulletin describing all of the Seaman-Andwall products. You'll see them at the Road Show — but send NOW for this valuable literature for your files. Mail a postcard today . . . ask for Bulletin CL-57.

Stabilizing the World

AMAN-ANDWALL
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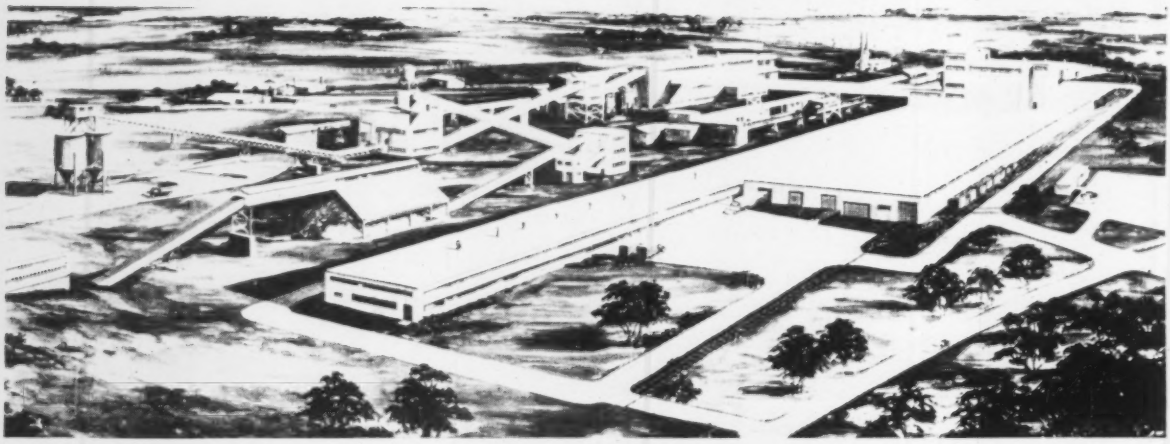
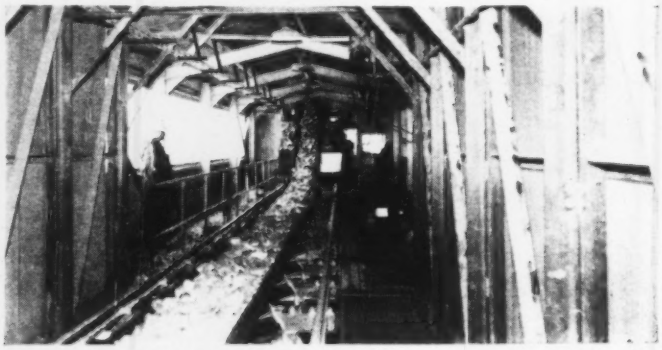


Barber-Greene installation at new Celotex plant. Ten of the eleven conveyors are housed. Building at far left houses primary crushers. At right is wallboard plant. Mill is in background.



(Left). Material rejected by the separator is carried to two storage bins by this 329-foot Barber-Greene conveyor. Standard 60-inch truss minimizes the number of supports required. (Right). A 422-foot conveyor in gallery utilizes traveling tripper to build long stockpiles.

1600′ conveyor system serves new Celotex plant

Eleven Barber-Greene conveyors are incorporated in the design of a new plant of the Celotex Corporation.

The 1600-foot conveyor system handles every product from the raw, heavy gypsum rock to the fine finished plaster. This processing requires a wide variety of types and sizes of conveyors—all coordinated to deliver continuous high capacity at lowest operating cost.

Built with *standardized* components, these versatile conveyors are delivered faster, go up easier and require less costly engineering time.

These pre-engineered components can be used in almost limitless combinations, from the most complex systems right down to the small setups requiring a single conveyor. When it comes to adapting Barber-Greene conveyors to meet changing needs, standardized components make the job easier, faster and more economical.

Write for literature on the conveyors pre-engineered to cut costs

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Barber-Greene

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

Tight Money Market May Curb Roadbuilders

Smaller highway contractors may not get enough financing to meet needs for working capital and equipment purchases

Many roadbuilders, particularly the smaller firms, may have serious trouble getting the financing they will need to take on an expanded volume of work on the vast new federal-aid highway program.

Some men in the construction industry, originally concerned with the question of whether states would be able to secure enough revenues to match the federal contributions, now feel that the financing roadblock for the road program will come at a much lower level—in the operations of the highway contractor and the construction equipment distributor.

The warning signs have been up for months. At a time when construction has been booming, equipment distributors, for example, have reported that more and more contractors are showing up on the "slow pay" list.

This does not mean that roadbuilders are in such financial troubles that they cannot pay their bills. But, it does seem to indicate that contractors are deferring payments as long as possible in order to maintain working capital.

This problem is expected to get serious as the volume of road work reaching the contract stage becomes larger. How serious it will get is difficult to determine, because many important questions remain unanswered.

• **"What do we use for money?"**—For the equipment distributor, who generally needs $500,000 in working capital to sell $1 million worth of equipment, industrial financing companies probably will assume more and more importance in extending installment credit to contractors for equipment purchases, and thus easing the distributors' financial burden.

For roadbuilders, the financing problem can be even more difficult.

To some extent, all roadbuilders in fact, all contractors—are affected by the higher interest rates and lenders' selectivity that characterize a tight money market. But, the bigger contractors are less affected than the growth-minded smaller firms.

• **The good risks first**—For the first time, many of the nation's estimated 9,000 highway contractors will have an opportunity—through the big new highway program—to utilize their full capacity and to expand.

With such "an enormous flow of work expected, this would seem to be the time for small roadbuilders to get big and big roadbuilders to get bigger.

But, equipment distributors already are being warned by lenders not to extend "too liberal" credit to the smaller, still unproven firms. The business principle is simple: Take the good risks first.

Banks, of course, follow a similar philosophy. One prominent banker was asked by ENGINEERING NEWS-RECORD if:

1. It would liberalize its present lending policies for highway contractors.

2. Roadbuilders will be encouraged to grow fast enough, financially, to meet the requirements of the accelerated 13-year highway program.

The banker said bluntly that his bank would not liberalize its lending policies. And, replying to the second question, he said:

"From the standpoint of the lending institutions, the problem is not to encourage roadbuilders to expand. Rather, it is a question of trying to keep them from taking on more work than their finances, resources and personnel justify."

Commenting that "extending credit to contractors is a hazardous field of financing," this banker added that roadbuilders may have some trouble getting increased credit because of the heavy credit demands of industry and business.

"Any contractor who plans to take on a big highway contract requiring a large investment in equipment should see to it that he has his financing arranged before he bids on the work," he added.

Three other important factors in the roadbuilders' credit picture:

• Surety companies are becoming more selective in writing bonds. This will tend to hold down the growth of some firms.

• Bidding on highway work continues to be extremely competitive. Contractors complain that jobs are going "too cheap."

• Profit margins of contractors generally have been declining for several years.

Some bankers feel all three of these problems could be cleared up rapidly—by the contractor—if jobs were bid more realistically. Said one lender:

"Chances are that banks would be encouraged to extend credit more liberally if they had the feeling that the successful bidders had larger profit margins. The percentage of contractor profit has been declining during the postwar years and is down to a point now where there isn't enough profit to absorb an occasional loss."

(*B&F continued on page 263*)

Caterpillar Plans New Engine Plant

Caterpillar Tractor Co. is planning a $200-million, three-year expansion program at Peoria, Ill., including an industrial engine plant, research facilities and general offices. The new engine plant will resemble Caterpillar's Decatur, Ill., plant, shown above.

Louis B. Sacco, maintenance foreman, J. Henry Harris, contractor, Berkeley, California

"T5X makes my job easier"

"My job of maintaining 250 pieces of construction equipment is made easier by using T5X Motor Oil in all engines, gas and diesel.

"Take this Mack with the NH200 Cummins—we just finished tearing it down after 150,000 miles. It was so clean and showed so little wear that we had it back on the job in record time. There wasn't a bit of sludge in the pan and the liners showed so little wear that we didn't touch them or even replace the rings. The only replacements were new rod bearings, a precaution taken while the engine was down.

"This is no record with us, however. We have another Mack with many more miles on it than this which hasn't had the head or pan off in more than 5 years, and it's still going strong."

What Mr. Sacco says is true. T5X Motor Oil can make motor maintenance easier and certainly less costly—from the standpoint of labor, parts and downtime. If you're not yet using the *amazing* purple motor oil, we suggest you place your next order for oil with your nearby Union Oil representative. Ask for T5X.

UNION OIL COMPANY 76
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Caught in Squeeze

Major Canadian realtor fails; tight money blamed

Effects of the current tight money market on Canadian commercial builders were dramatized last week when Ridout Real Estate Ltd. of Toronto, one of the world's largest real-estate developers, went into bankruptcy.

The company did an annual sales volume of about $80 million, carried on its operations from 27 branch offices and had 500 employees.

Storm warnings went out shortly before Christmas when Ridout discharged more than 100 employees and prepared to close most of the firm's offices in 25 Ontario cities. The petition of two former sales executives, who claimed the company owed them $4,994 in back commissions, resulted in initiation of bankruptcy proceedings against the firm.

The bankruptcy order was not protested. "After appraising the financial situation of Ridout's real estate empire, we decided it would not be prudent to continue operations," V. J. C. O'Mara, legal counsel for Ridout told the court Jan. 3. The company, he said, had tried without success for the previous three weeks to find a solution to the "financial embarrassment."

The firm's financial debacle was due in part to the tight money situation, which made it almost impossible to obtain mortgages and operating capital, explained O'Mara.

But, he emphasized, "the undue haste of one of the discharged employees in filing a petition aggravated and accelerated the Ridout business decline."

"Even yet, with cooperation from creditors, some solution may be worked out so that the company can readjust itself and resume business at a future date," the attorney said.

Ridout Real Estate, which was formed in the postwar boom of 1946, figured in many of Ontario's largest developments.

A $40-million Toronto redevelopment project in the Wood and Alexander Sts. area is not expected to be affected by the developer's troubles. Ridout was the agent for backers of the apartment house project still in the planning stage.

An interesting sidelight: In mid-December, a major U.S. developer, William Zeckendorf, Jr., of Webb & Knapp, purchased from Ridout an option to redevelop part of the downtown area of London, Ontario.

(B&F continued on page 264)

Construction Markets

An On-the-Spot Report From Kansas City

Known primarily as a livestock, grain and rail center until the early 1940's the Greater Kansas City area (embracing six counties in Kansas and Missouri) now is attempting to retain its World War II industrial acquisitions and to bring more industry into the area.

Attracting new industry is a major aim of city and civic leaders for 1957. To do this, the Mid-Continent Development Council has been established with L. E. Tattin, a former Southwestern Bell Telephone Co. executive, as president.

Greater Kansas City is making progress on other fronts, too. The Metropolitan Area Planning Council has been formed to coordinate existing and planned facilities such as water distribution and sewerage systems, highways and governmental functions.

This planning council is trying to mesh the operations of an estimated 350 political jurisdictions in the six-county metropolitan area.

The area's present 1-million population is expected to swell to 1.3 million by 1970. An influx of industrial plants, commercial buildings and residential development seems axiomatic to local leaders.

They feel that one of the most difficult problems facing the municipal and county authorities is the increase in utility services to meet these increased demands.

The greater Kansas City area already is making a name for itself in industrial circles. It is second only to Detroit in assembly of automobiles.

General Motors has two large plants in the area, one in the Fairfax district of Kansas City, Kan., where Buicks, Oldsmobiles and Pontiacs are assembled in a plant used for production of B-25s during World War II.

The Chevrolet Division of General Motors in Kansas City, Mo., has just announced a $25-million, three-year expansion program.

Ford Motor Co., in Clay County, Mo., just outside the Kansas City limits, began automobile production two weeks ago in a 1-million sq ft plant formerly used for airplane production.

Westinghouse and Bendix occupy a large plant in Kansas City, Mo., where Pratt & Whitney produced aircraft engines in World War II. Westinghouse now is turning out jet engines; Bendix production is supersecret. But, it is known that Bendix will spend $2 million this year to expand its facilities.

In downtown Kansas City, Mo., land acquired as part of an urban renewal project will be the site of an eight-story office building to house the long-lines department of American Telephone & Telegraph. The building will cost more than $4 million.

These are some of the signs of the industrial and commercial renaissance in the Greater Kansas City area.

But public works are not being neglected.

Kansas City, Mo., has made a good start on a $52-million program to enlarge its water treatment and distribution facilities to stay one jump ahead of the population growth.

And, like most major areas, Kansas City expects expressway and other highway programs to bolster its construction economy.

In the immediate future is a limited-access freeway loop around the main business district. First leg of this project will be completed within 18 months. It will link with an existing expressway carrying traffic to the southwest.

Now in the planning stage are a Southeast Trafficway and two connecting links that will speed traffic in all directions from Kansas City's core area.

Under construction between Kansas City, Kan., and Platte County is a twin span to an existing structure. This project, which will cost $5.3 million, will be a toll bridge, handling northbound traffic only. The companion span, handling southbound traffic, will be toll-free.

Indicative, too of Kansas City's new march of progress is hospital construction in the metropolitan area. Within two years, 800 beds will be added. In all, 19 hospitals either have started or will start this year expansion programs costing more than $12 million.

Housing is slack in Greater Kansas City, with starts in 1956 down 26% from the peak of 11,600 in 1955. Builders doubt that 1957 activity will top last year's 8,000 starts.

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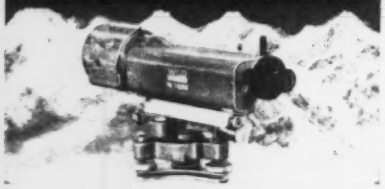

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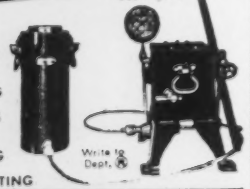

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Boston Uncorks Bottled-up Project

Combine plans $30-million commercial development in area cleared through urban renewal program; work starts soon

Boston's construction picture started the new year brightly with announcement that the long-stalled New York Streets section in the city's South End will be the site of a $30-million commercial development.

The 16-acre section has been purchased by a combine headed by Martin Cerel, well-known New England builder and developer and Richard A. Druker, president of the Boston Real Estate Board. Purchase price of the land was $400,000.

Construction is expected to start this spring with plans calling for $30 million worth of buildings, including 20 commercial and light industrial buildings. Two of the proposed buildings will be eight stories in height.

The New York Streets development was the city's initial urban renewal site. Its sale is expected to set off a chain of redevelopment projects.

One large construction project that is expected to follow is a new office building and commercial center on the site of the Boston and Albany freight yards in the Back Bay district. Prudential Insurance Co. is prominent in this plan.

Prudential soon will announce completed plans for this development, which could cost as much as $100 million.

A contract for site improvements in the New York Streets area already has been awarded to Salah and Peter Construction Co., of Brookline, Mass., for $476,631. Improvements include street layouts, installation of sewers and water mains and utilities.

Construction of buildings will be started almost simultaneously with completion of the site improvements.

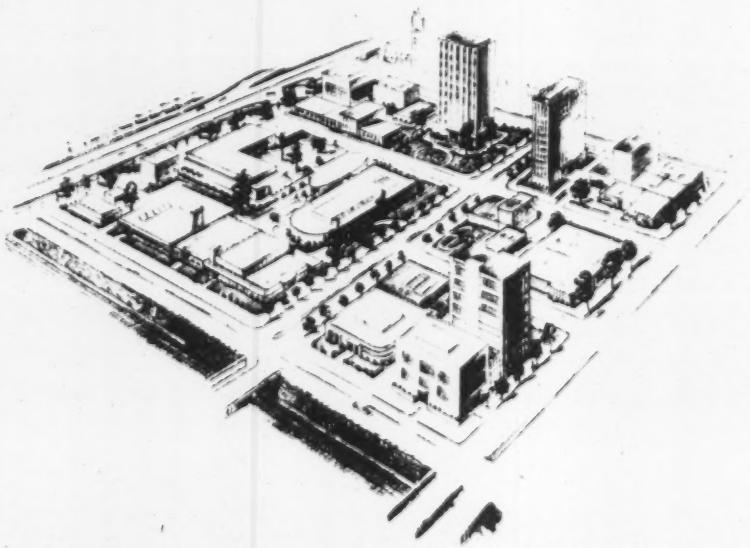
Boston now has a master plan for redevelopment of the entire area from the Back Bay to South Station with such sponsors as Prudential, William Zeckendorf, of Webb & Knapp, and Martin Cerel, whose mass-housing projects around the fringes of Boston attracted national attention.

The total investment in this overall development could run as high as $350 million just on the basis of present plans.

The master plan has been mapped by Webb & Knapp.

Included is a proposed extension of the East West tollroad from its existing planned terminus at Route 128 in Weston into the heart of Boston, running through the Back Bay Center to the South Station, adjacent to the New York Streets development.

These tollroad plans, however, are currently tangled in litigation.



$30-MILLION COMMERCIAL DEVELOPMENT in New York Streets section of Boston will be launched by a combine headed by builder Martin Cerel and realtor Richard A. Druker. Site, purchased for $400,000, was cleared for urban renewal.

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coarse crushing
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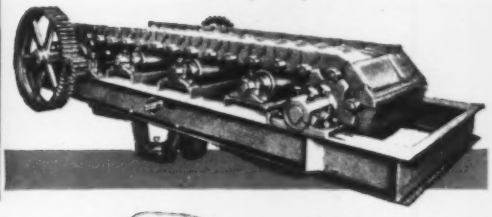
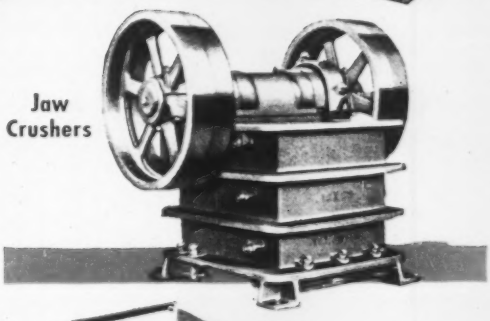
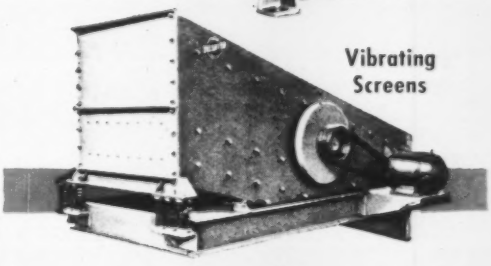
EQUIPMENT
FOR AGGREGATE



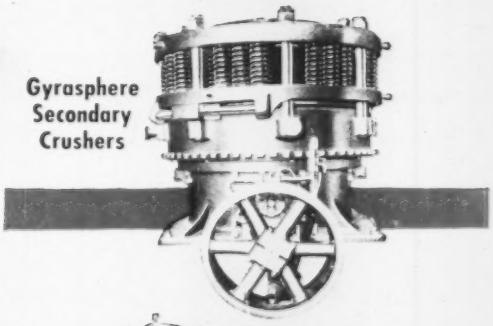
Heavy-Duty Feeders



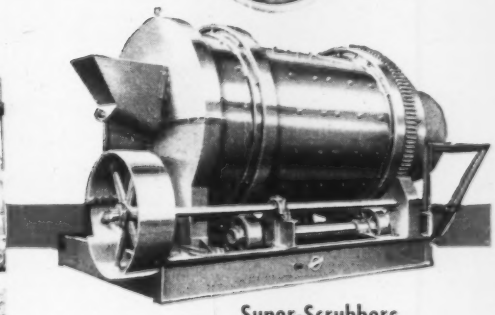
Jaw Crushers



Vibrating Screens



Gyrasphere Secondary Crushers



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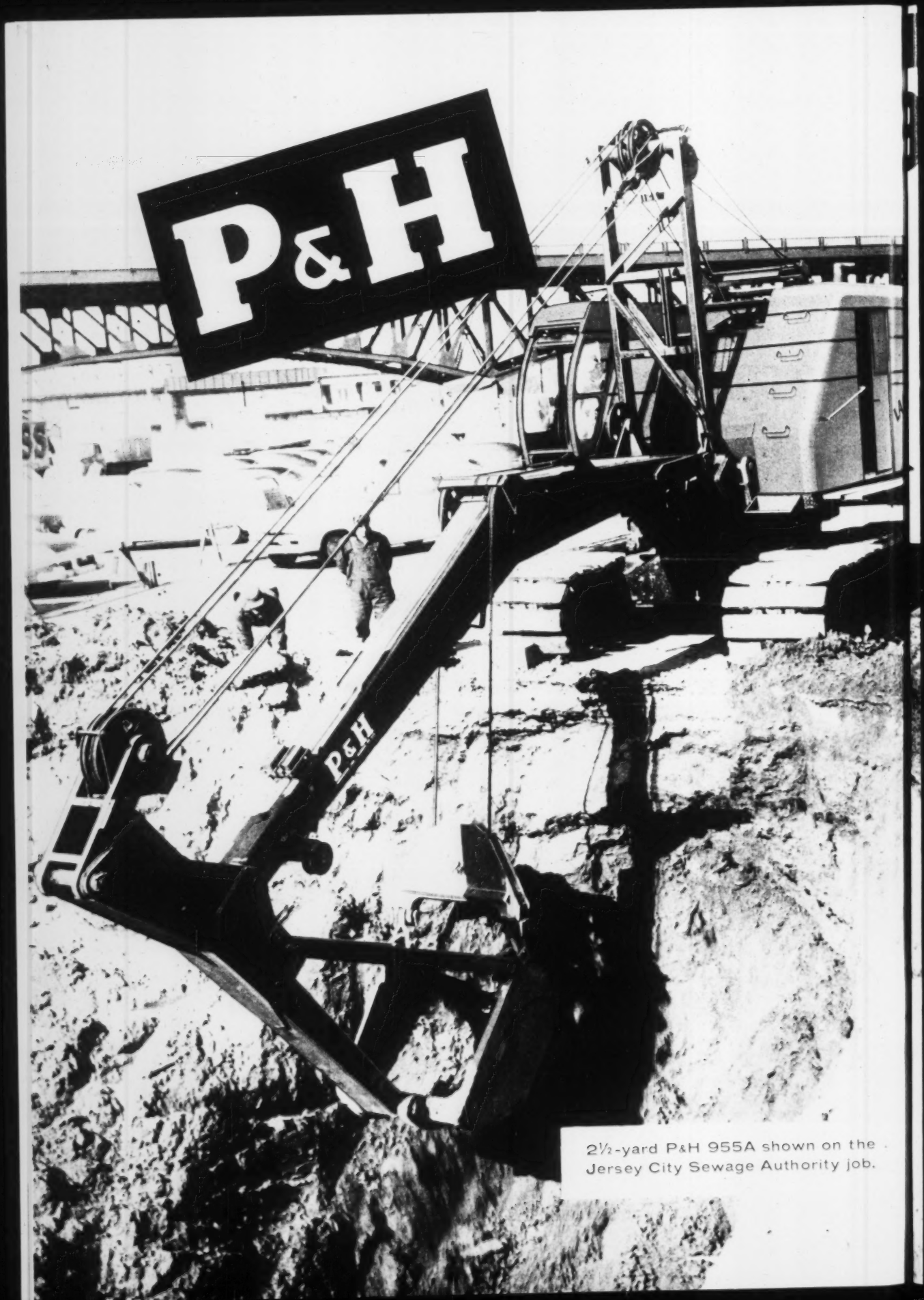

2½-yard P&H 955A shown on the Jersey City Sewage Authority job.

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¢ a cu.yd....283½ yds.an hour

with 2½ yd. P&H "Job-Designed" Trench Hoe

Each year more and more contractors are upgrading their equipment to the greater speed, power, accuracy and profitability of P&H "job-designed" power cranes and shovels.

The P&H 955A, pictured at the left on the Jersey City Sewage Authority job, digs 283½ cu. yds. an hour at a cost of 9¢ per cu. yd. (depreciation excluded) for the LaFera Contracting Company, Newark, N.J.

There's good reason for this typically profitable P&H performance. With the 955A it begins with Magnetorque† — the simplest and most advanced power drive known. Magnetorque transmits power for swings electro-magnetically — without friction, without wear. Swings are smoother, more easily controlled — and from 15% to 25% faster.

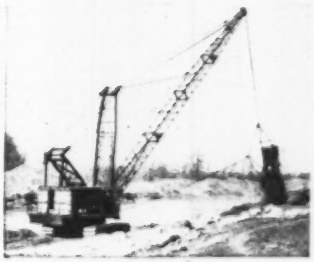
In addition to Magnetorque, you get P&H greater stability for more power at the tooth point — rapid reversing chain crowd for snappier dipper action — direct hydraulic control for smoother, easier control. This combination of outstanding P&H features gives the 955A the power, speed and flexibility to get the best performance out of your best operators.

Call your P&H dealer soon. No matter what the capacity needs or nature of your job, he can show you a P&H model that will help you dig more and lift more at a lower cost. Harnischfeger Corporation, Construction & Mining Division, Milwaukee 46, Wisconsin.

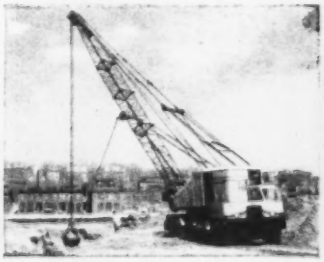
†T.M. Harnischfeger Corp. for electro-magnetic type coupling.

THE P&H LINE Truck Cranes: 8, 10, 15, 20, 25, 30, 35 and 40 tons
Shovels: ½, ¾, 1½, 1¾, 2½ and 3½ yards

Across the country P&H machines lead the field in power, speed, flexibility and profitable performance



INDIANA
For larger loads there is the big 3½-yard P&H 1055. At Standard Material Corporation's White River plant it is used to hold down costs in handling aggregates.



RHODE ISLAND
Gammino's of Providence depend on 35-ton P&H 555A-TC truck cranes for fast, economical performance in excavating on the big North South Freeway job.

TEXAS
In the 1½-yard class, T. F. Jones Construction Co. profits from greater strength of the P&H 655B shown above on a Texas Highway Project in Hockley County.

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Harnischfeger Corporation, Dept. 500-A
Construction & Mining Division
Milwaukee 46, Wisconsin

Gentlemen:
Please send me field report No. 5505 on the 2½-yard P&H 955A.

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*Title*_____

*Firm*_____

*Street*_____

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Management official proposes a . . .

Jurisdictional Disputes Plan

A specific plan for improving existing procedures for the settlement of jurisdictional disputes within the construction industry has been proposed for consideration by the building trades in New Jersey, as well as the international unions and the National Joint Board for the Settlement of Jurisdictional Disputes. Key to the plan, which consists of a series of settlement conferences starting at the local level, is a pre-job conference designed to forestall disputes before they arise.

The proposal was made last Sunday by Paul Brenza, managing director of the Building Contractors Association of New Jersey, management spokesman for the state's construction industry.

First step proposed in the four-phase plan for New Jersey is a pre-job conference of the general contractor, subcontractor, architects, and business agents of unions whose members will be employed. Plans and specifications would be reviewed, materials and equipment to be used would be discussed and job assignments would be made. The union business agents concerned would attempt to resolve any jurisdictional conflicts arising at the conference.

Disputes not settled at the pre-job conference by the business agents of the unions disputing the assignments would be referred to a special joint committee to be organized by the New Jersey unions at the state level—each craft forming its own three-man jurisdictional dispute committee, so that the full committee before which a dispute would go would consist of six members, three from each of the two conflicting unions.

If no settlement is reached at the state level, the dispute would then go to another union committee, identical in form to the state committee but organized on the international instead of the state level.

Disputes not resolved on the international level would then go before the National Joint Board.

In presenting the plan, Brenza said the proposal is premised on management's recognition of the fact that the "settlement of jurisdictional disputes is a matter which the unions should settle themselves voluntarily and peacefully." He expressed the hope that union consideration of the proposal, on which he invited suggestions and recommendations, might "be the beginning of a feasible method of settling these disputes," in which an increase may well be expected because of technological changes and the use of new materials.

Jurisdictional disputes, Brenza asserted, have been the "direct cause of unnecessary" strikes and work stoppages that have halted millions of dollars worth of construction, thrown building tradesmen out of work and saddled contractors and the public—both innocent victims—with extra costs. In New Jersey alone, he said, there were 365 such disputes last year, affecting over a half-billion dollars of construction and precipitating work stoppages of one to 60 days' duration.

Explicitly part of Brenza's plan, which contains a timetable of 13 days for running the procedural gamut, are these stipulations:

- No work stoppages would occur while efforts to settle a dispute are under way.
- Decisions of the business agents at the pre-job conference would be binding on the respective union locals within their entire jurisdiction.
- Decisions of the state committee would be binding on the respective unions as to all jobs within the state.
- Decisions reached at the international level would become international agreements binding all affiliates of the respective unions.
- Decisions of the Joint Board would be binding on the respective unions throughout the nation.

In contrast to the last stipulation, Joint Board decisions now bind only the union locals and the contractors involved in a particular dispute, and are effective only as to the specific project at which the dispute arises.

To assure effectiveness of the plan, a contractor whose project is struck in violation of the plan would be required to file an unfair labor practice charge against the offending union with the National Labor Relations Board.

Pay Scales of Five Trades Are Increased in Hawaii

The General Contractors Association has granted wage increases of 15 and 29 cents an hour to construction workers in Hawaii, where military and public works activity is expected to push construction volume to new peaks this year.

Under the new pay scales adopted Jan. 1, carpenters and cement finishers moved up to $2.45 an hour, painters to $2.15, truck drivers to $2.00 and heavy crane and shovel operators to $2.75.

Electricians and plumbers were raised to $2.60 an hour last August.

Construction laborers in the Hawaiian Islands now get $1.75 an hour.

Another Medium for Industry Promotion

Industry promotion through the joint efforts of labor and management has found another form of expression in the southwest, where union bricklayers and brick and tile manufacturers have joined hands in selling their products to television audiences.

The advertising device is a studio backdrop in the form of a brick wall presented to stations KGNC-TV, Amarillo, Tex., and KTBS-TV, Shreveport, La. The walls are used by the stations in live studio shows and serve as a silent spokesman for masonry construction.

Labor for the building of the Amarillo wall was contributed by members of bricklayers' Local 19 and for the one in Shreveport by apprentices of Local 2. In each case, the brick was contributed by Clay Products Association of the Southwest, a regional group of brick and tile manufacturers.

The Amarillo wall of red Roman brick is 27 feet long, 10 feet tall. Commenting on the gift, the station manager said: "We have used it to many advantages for our commercial set and with the versatility of the brick we can make endless set changes."

In Shreveport, the donors put their gift to a double use. After the wall was completed, the television studio put on a 30-minute telecast featuring the U.S. Labor Department's film "Apprentice Training".

According to the bricklayers union, the idea is being favorably received in other areas of the southwest. Says the union in the current issue of its monthly journal: "When the general public of two southwestern cities can see a goodlooking brick wall—built by union labor—every time the station puts on a live show, then you can be sure that eventually this will result in more good will for the product and for the union craftsman.

(*Labor continued on page 271*)

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How to select compaction equipment

The logical question to ask yourself when you are ready to buy new compaction equipment is: "Exactly what do I need the equipment for and how will I use it?"

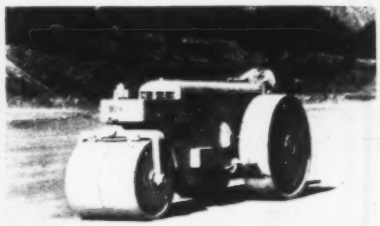
BASE FILL COMPACTION—This type of compaction demands equipment that will handle a wide variety of materials, give you the highest degree of compaction with the fewest passes. Buffalo-Springfield's revolutionary K-45 Kompactor is proving a real money-making answer for this type of work. It is self-propelled, relies on the "Interrupted Pressure Principle." All compaction effort is directed downward. Contractors testify they are meeting density requirements in one-fourth the time normally required with other compaction equipment.

FINE GRADE FINISHING—Buffalo-Springfield offers six 3-wheel rollers, ranging in capacity from 5 to 15 tons, to handle the large variety of materials found in fills, subgrades and unfinished bituminous pavements. The variable-weight 3-wheel roller is ruggedly built for years and years of hard, maintenance-free work.

Buffalo-Springfield's thoroughly-proved 3-axle tandem "walking beam" roller provides up to 60% greater tonnage compacted per day in superhighway construction, airport and military establishment jobs where specifications are extra strict.

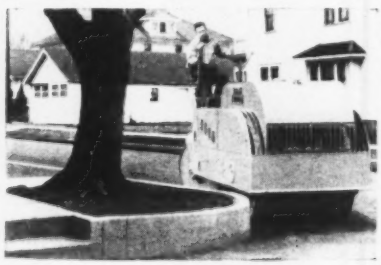
ASPHALT FINISHING—Two-axle Tandem Rollers are designed especially for all surface finishing jobs. Ranging from 5 to 16 tons, Buffalo-Springfield Tandems are used for

THE BUFFALO-SPRINGFIELD KX-3 AXLE TANDEM



3-WHEEL ROLLERS

heavy-duty highway and public works projects, and all types of finishing, maintenance and repair work. A wide selection of models for the biggest to the smallest jobs are designed for long-life and profitable operation.



TWO AXLE TANDEMS

SHORT ROLLING JOBS—Buffalo-Springfield's 3-5 ton portable roller is widely used for rolling driveways, sidewalks, parking and playground areas, and for patching and light finishing jobs. It is highly maneuverable and portable from job-to-job. Write today for full information on the type of equipment you need—or see your nearest distributor for an on-the-job demonstration.

3-5 TON PORTABLE TANDEM

THE STANDARD OF COMPARISON

KOEHRING KOMPLETE

BUFFALO-SPRINGFIELD
Roller Division-Koehring Company
SPRINGFIELD, OHIO

Safety Isn't Self-Propelled

Closer cooperation of labor, industry and government is considered essential to more effective safety promotion work

Although on-the-job accidents are still taking a heavy toll of the nation's human and economic resources, safety techniques that have been developed are capable of preventing most of the nation's work injuries. The crucial task appears to be that of selling the techniques to employers, particularly the smaller ones, and of selling safety-consciousness to workers.

Those are the conclusions of the U. S. Labor Department's Bureau of Labor Standards after taking a look at safety problems and progress.

• **Construction**—The problem is especially acute in the construction industry, where the chances of having an accident are considered three times greater than in manufacturing industries. Figures cited by the AFL-CIO Building and Construction Trades Department to show the magnitude of the problem include these: In 1955, 210,000 construction workers were injured on the job—2,500 were killed and 6,600 never fully recovered; income loss to the injured was $250 million; compensation and hospital costs came to $112 million; and total indirect costs approached $450 million.

In general, the Bureau of Labor Standards found that the construction industry is one in which the volume of work injuries tends to rise and fall with fluctuations in employment. The industry's volume of injuries in recent years, for example, reached a peak in 1941 due largely to the increase in construction inspired by the war, declined sharply in 1942-44, and since the war has "closely paralleled employment trends in the industry".

Factors generally conceded to make accident prevention in the construction industry a challenging task are many. Among them are these: the unique nature of construction operations that range from excavation and underground work to work at great heights; the high level of labor turnover; the short duration of most jobs; variations in job conditions, and the division of responsibility between general contractors and subcontractors.

• **Self-policing**—American industry has, for the most part, attempted to police itself in safety, the bureau observes, and has developed a host of safety programs, codes and guides. An example mentioned by the bureau is the expanded accident-prevention program of the Associated General Contractors of America, Inc., which believes the most effective prevention comes voluntarily from within the industry rather than compulsorily from without.

Guides for effective accident prevention claimed by the bureau to be recognized generally by industry include a constant executive interest in safety; a company safety policy; adequate communications with employees; physical safeguards and compliance with safety codes; education of workers through safety training and supervision; and employee participation in safety programs.

Credit for much of the accident-prevention progress to date is given by the bureau to the American Standards Association, the National Safety Council, the American Society of Safety Engineers, the President's Conference on Occupational Safety, and state and federal governments that have either enacted safety laws and developed methods of supervision or provided the information and leadership essential to an effective war against occupational injuries.

But the activities of most of these, whether voluntary or compulsory, have been directed necessarily to the control of physical hazards, the bureau notes, leaving as one of today's big challenges the still unanswered and critical question of "What motivates a man to work safely?"

• **Cooperation**—Recognition of the fact that the nation cannot depend upon laws alone to prevent accidents has prompted a few states, the bureau observes, to try a "consultative" approach to accident prevention. One of the states is New York, where the experiment, which is now concentrating on the construction industry, has been described officially as "a total and cooperative approach to accident prevention". To U. S. Secretary of Labor James P. Mitchell it is a reflection of the modern concept that "a state labor department's service to industry is no longer that of a policeman but of a friendly and highly trained consultant". Other states, in cooperation with the Bureau of Labor Standards, also are devoting special attention to programs in industries with high injury rates.

The cooperative approach, the bureau observes, is advocated by organized labor, which has felt that neither legislation nor collective bargaining—two tools it constantly has used—can single-handedly perform the mission. The AFL-CIO, whose Standing Committee on Safety and Occupational Health is headed by teamster President Dave Beck, has, for example, expressed the conviction that safety "can be attained only by initial action at the level of each individual plant or workplace" and that an effective job cannot be done without the voluntary cooperation of all concerned.

The same approach has been taken by the federation's Building and Construction Trades Department, whose President Richard Gray, viewing the problem as a "two-way street", repeatedly has urged all construction workers and contractors to work together to minimize the human destruction and heavy costs of accidents.

Labor Briefs...

• **Right-to-work**—A petition for an injunction filed in a County Court by Palm Springs, Calif., building trades, teamster and culinary union locals challenges the validity of a right-to-work ordinance adopted by Palm Springs. Unfair labor practice charges have also been filed against the City Council with the NLRB.

• **Association bargaining**—Question of whether "a strike against one is a strike against all" in multi-employer bargaining is before the U. S. Supreme Court. Arguments were heard last week on a Circuit Court (New York) ruling against a lockout by an employer association during a teamster strike.

• **Jurisdiction**—The Joint Committee of the AFL-CIO Building Trades and Industrial Union Departments will consider on Jan. 28 a peace proposal—still officially undisclosed—made by President Meany for settling jurisdictional disputes over industrial maintenance and construction work.

• **Prevailing wages**—Representatives of unions affiliated with the AFL-CIO and of independent railway groups in Maryland have approved a legislative program that calls for passage of a state law requiring payment of prevailing wages on public projects.

• **Holiday exchange**—The Labor Department's wage-hour and public contracts division has revoked its earlier exemption from overtime requirements for work on the last day of a six-day week scheduled so as to give workers a four-day holiday weekend. Revocation followed a review of experience under the short-lived exemption.

OFFICIAL PROPOSALS

RATE: The rate for Official Proposal advertising is $2.10 per line or fraction set solid. Where the advertisement is set other than solid, the space is measured by total space occupied and charged on basis of 12 lines to the inch.

CLOSING DATE: Friday 10:30 A.M. for issue dated the following Thursday.

SEND COPY TO: Official Proposal Division, Engineering News-Record, P.O. Box 12, New York 36, N. Y.

Bids—January 21, 1957.

New York State Road Work

NOTICE TO CONTRACTORS—STATE DEPARTMENT OF PUBLIC WORKS—ALBANY, N. Y.—Pursuant to the provisions of the Highway Law, Article 2, Title 9 of the Public Authorities Law, and special provisions for projects financed with Federal Aid Funds, sealed proposals will be received until ten-thirty o'clock A.M., eastern standard time on the 21st day of January, 1957, by Henry A. Cohen, Director, Bureau of Contracts and Accounts, 11th Floor, The Governor Alfred E. Smith State Office Building, Albany, N. Y., for the following projects:

Project	Contract No.	Name	Miles	Type	Deposit	Estimated Cost of Work
DISTRICT No. 2, Louis Ketchum, District Engineer, 109 No. Genesee St., Utica, N. Y.						
Schenectady and Montgomery (Rt. 5S)	FARC 57-8	Amsterdam-Pattersonville, S.H. 8318 Rotterdam Junction-Pattersonville, S.H. 640 Project U-F-488-7	5.88 (0.95 RR) —	9" Cem. Conc. Pavt. 24' Wide = 5.81 Mi.; Misc. Work = 1.02 Mi.; Prestress. Conc. Beam Bridge 60'; Extend. Exist. 22' Reinf. Conc. Slab	$82,000 Plans $25	$1,486,000
DISTRICT No. 3, Wm. Rogerson, Weigh Lock Bldg., Syracuse, N. Y.						
Onondaga and Oswego	FISH 57-3	Interstate Route 5 Bypass Section, to Central Square and Access or Local Roads Project I-1118-4	3.52 (1.01 Acc.)	9" Cem. Conc. Pavt. 2 at 36' Wide = 2.92 Mi.; Asp. Conc. Opt. = 0.38 Mi.; Asp. Conc. Opt. Access = 1.01 Mi.; Misc. Work = 0.02 Mi.; 3 Hy. Sups. Comp. I-Beams, 244'9", 90' & 127'6"; 1 Br. St. Arch & C.I.B. 44'	$360,000 Plans $50	6,520,000
Onondaga (Rt. 5)	FARC 57-9	Fayetteville Village, Genesee St., S.H. 5660 Project F-329-7	0.25 (0.11 Int.	9" Cem. Conc. Pavt., 50' Wide = 0.12 Mi.; Asp. Conc. Tr. IX = 0.24 Mi.; Comp. I-Beam Bridge 260.5'	$24,000 Plans $10	434,000
DISTRICT No. 4, B. F. Perry, District Engineer, Barge Canal Terminal, Rochester, N. Y.						
Livingston (Rt. 36)	FARC 57-10	Caledonia-Mount Morris, Pt. 4, S.H. 5005 Project F-1053-4	0.30	9" Cem. Conc. Pavt., 24'-36' Wide = 0.29 Mi.; Misc. Work = 0.01 Mi.; Continuous Girder Bridge 340'	$30,000 Plans $15	547,000
DISTRICT No. 5, E. G. Hoffmann, District Engineer, 65 Court Street, Buffalo, N. Y.						
Erie	FINFC 57-11 PSC 9058	New York State Thruway—Niagara Section, Sub. N-5; Elim. of the Grade Crossing of the New York Central Railroad and Porter Avenue, City of Buffalo Project I-865-13	1.92 (0.92 Acc.)	R.R. Relocation = 1.25 Mi.; 9" Cem. Conc. Pavt. Var. Wide = 0.77 Mi.; Asp. Conc. Opt. = 0.59 Mi.; Misc. Work = 0.23 Mi.; R.R. & Hy. Sups. Comp. I-Beam, 192.5'; Ramp Comp. I-Beam, 225'	$75,000 Plans $25	$1,383,000
Erie	BIST 57-9	Connection between New York State Thruway-Niagara Section, Sub. N-8 and Base Line Road (Buckhorn Island State Park)	1.18	Asp. Conc. Opt. = 1.16 Mi.; Misc. Work = 0.02 Mi.; Comp. I-Beam Bridge, 90'	$10,500 Plans $15	$188,000
Erie (Rt. 5)	FAC 57-1 FAC 57-2	City of Lackawanna, Arterial Route, Fuhrmann Blvd.-Hamburg Turnpike Viaduct and City of Buffalo, Arterial Route, Project U-750-7)	0.77	Substructure for Viaduct	$160,000 Plans $25	$2,936,000
DISTRICT No. 6, James H. Thomas, District Engineer, 30 W. Main Street, Hornell, N. Y.						
Allegheny (Rt. 19 and 244)	FARC 57-4	Friendship-Belmont, S.H. 5341; Belmont-Scio, S.H. 5476; Belmont-Phillips Creek, Pt. 1, S.H. 1559 Project F-332(7); F-514(4)	2.85	Asp. Conc. Opt.; Cl. Box Br. 22'; Repair Exist. Rig. Conc. Arch Br.; Reinf. Conc. Slab Br. 32'; Raise & Repair Exist. Truss Br.	$42,000 Plans $15	$770,000
DISTRICT No. 7, Robert W. Sweet, District Engineer, 444 VanDuzee St., Watertown, N. Y.						
Jefferson	FISH 57-2 FARC 57-15	Interstate Route 5 (Section 7C-1) and Access or Cross Roads including S.H. 425 and S.H. 237 Project I-IG 1118(5); F-327-10	7.26 (6.79 Acc.)	Asp. Conc. Tr. 2B = 0.21 Mi.; Asp. Conc. Opt. = 13.23 Mi.; Grad. & Drain. = 0.61 Mi.; 1 RR Sep. Comp. I-Beam, 140'; 4 Hy. Seps. Comp. I-Beam, 252'3", 149', 355.2' and 205.8'; 4 Brs. R.C. Twin Boxes 20' Each.	$395,000 Plans $100	$7,182,000
Lewis	FASS 57-13	Remington Corners-Indian River-Croghan, Pt. 2, Co. Rd. Project S-337-2	5.37	Bit. Mac. Tr. 1 Pen. Meth. Pre-Stressed Conc. Beam Br., 180'	$48,000 Plans $25	$700,000
DISTRICT No. 8, K. G. Rayer, Acting District Engineer, Pleasant Valley Road, Poughkeepsie, N. Y.						
Putnam (Rt. 9)	FARC 57-3	Peekskill-Fishkill, Pts. 3 and 4, S.H. 5156-5149 Project F-394-15)	4.06	Asp. Conc. Opt.	$19,000 Plans $10	$340,000
Rockland	HT 57-1 RC 57-4	New York State Thruway—Hudson Sect., Sub. 9A and New Jersey State Line-Nyack, Pts. 3 & 4, S.H. 8136-5082	3.20 (1.52 Acc.)	Asp. Conc. Shoulders = 3.04 Mi.; 9" Cem. Conc. Var. Wide with A.C. Should. = 0.24 Mi.; Asp. Conc. Opt. and Misc. Work = 0.17 Mi.; Misc. Work = 0.37 Mi.	$18,000 Plans $10	$317,000
Ulster (Rt. 55)	RC 57-5	Napanoch-Montela, S.H. 603	3.70	Cable Guide Railing (RR Rail Posts)	$4,000 Plans $10	$75,000
Ulster (Rt. 55)	FASH 57-1 FARC 57-10	Gardiner-Kerhonkson, Pt. 3, Gardiner-Kerhonkson, Pt. 2, S.H. 8389. Project F-451-4	1.61	Asp. Conc. Opt.; 1 Comp. I-Beam Br. 255'; 2 Reinf. Conc. Box Brs. 25.1' and 21.9'	$40,000 Plans $15	$723,000
Westchester	NLT 57-1	New York State Thruway—New England Section—Sub. NE 1 (N.Y.N.H.&H.R.R. at Larchmont)	0.85	Modifications of R.R. Facilities and Re-routing of Communication Lines	$12,000 Plans $25	$220,000
Westchester (Rt. 9)	FARC 57-2	Peekskill-Fishkill, Pt. 1, S.H. 5147 Project F-394-14)	1.67	Asp. Conc. Opt.	$8,500 Plans $10	$156,000
DISTRICT No. 10, M. E. Gott, District Engineer, 325 W. Main Street, Babylon, L. I., N. Y.						
Bronx	FA MDE 57-2	Major Deegan Expressway & Extension (Cont. Pt. 148th St. to N. Y. City—West Co. Line), Project U-1082-2(5)	7.33	Miscellaneous Work	$11,000 Plans $15	$200,000
Suffolk (Rt. 27	BC 57-6	Amagansett-Montauk Point, Pt. 2, S.H. 8381	7.49	Timber Guide Railing	$4,200 Plans $10	$78,000
Suffolk (Rt. 25, 25A, 111)	FARC 57-7	Smithtown-Port Jefferson, S.H. 5232A; East Islip-Smithtown Branch, S.H. 1208. Project S-430-3)	2.81	Asp. Conc. Opt. = 2.62 Mi. Misc. Work = 0.19 Mi.	$40,000 Plans $15	$742,000

Any projects in this letting that are on the Federal Aid highway systems are subject to the provisions of the "Federal-Aid Highway Act of 1956", being Public Law 627, 84th Congress, approved June 29, 1956, and are also subject to the applicable New York State statutes.

In compliance with the provisions of Section 115, Prevailing Rate of Wages Public Law 627, the minimum wages to be paid laborers and mechanics are included in wage schedules that are set out in the bid proposal.

Maps, plans, specifications and proposal forms may be seen and obtained at the office of the State Department of Public Works, Bureau of Contracts and Accounts, Albany, N. Y., and at the office of the District Engineers noted above, and may also be seen at the office of the State Department of Public Works, 270 Broadway, New York City.

The deposit for Plans and Proposal Forms for each contract is indicated above. A refund will be made in full to bidders for return of one set, in good condition, within 30 days of award, or rejection of bids; refund for all other sets in good condition, similar period, will be 50% of deposit.

Special attention of bidders is called to "General Information for Bidders" in the proposal, specification and contract agreement, and to the special provisions applying to projects financed with federal funds. Award of a contract is subject to priorities and allocations under the Defense Production Act of 1950, as amended, and all regulations issued thereunder.

Proposal for each contract must be submitted in a separate sealed envelope with the name and number of the contract plainly endorsed on the outside of the envelope. Each proposal must be accompanied by draft or certified check payable to the order of the "State of New York, Commissioner of Taxation and Finance" for the sum as specified in the advertisement and the proposal. The retention and disposal of the bidding check, the execution of the contract and bonds shall conform to the provisions of the Highway Laws, as set forth in "Instructions to Bidders". The right is reserved to reject any or all bids.

JOHN W. JOHNSON
SUPT. OF PUBLIC WORKS

OFFICIAL PROPOSALS

GOVERNMENT OF IRAQ, DEVELOPMENT BOARD AND MINISTRY OF DEVELOPMENT, NARROW GAUGE RAILWAY EQUIPMENT FOR THE EXPLOITATION OF THE QUARRY FOR HAMMAM AL-ALIL CEMENT PLANT, CALL FOR TENDERS. The Development Board and Ministry of Development of the Government of Iraq invites tenders for the supply of: Diesel locomotive, tipping cars, open passengers cars, narrow gauge railway tracks, tipping system and laying of tracks. Tenders must be submitted for the full supply of the Equipment listed above. The Documents for Tender, including General Information, General Conditions, specifications and models of schedules of rates and prices may be inspected on and after the *15th January 1957* till 7th February 1957 at the following addresses: at Directorate General of Contracts Ministry of Development—Development Board, Baghdad. At Embassies of Iraq in Washington, London and Paris, at Royal Legations of Iraq in Bonn, Brussels and Rome, at on appointment, at the Office of the Consulting Engineers, Messrs. Etudes et Recherches Industrielles, S.A., 12 rue d'Egmont, Brussels. Firms desiring to tender may obtain copies of the Documents for tender on and after the *15th January 1957* till 7th February 1957, from either the Directorate General of Contracts at the Development Board offices, Baghdad, or Messrs Etudes et Recherches Industrielles, 12 rue d'Egmont, Brussels or the above mentioned Embassies and Legations, on payment of I.D. 2, or the equivalent of same in other currency. This charge will not be refunded to the Tenderers. Tenders will be considered only from Firms or Persons who are members of a Chamber of Commerce. The tenders shall be in English, and they must be accompanied by a preliminary deposit of I.D. 5000 not which must be paid in cash to the Directorate General of Accounts of the Board, Ministry of Development, Baghdad, and the receipt issued for such payment must be attached to the tender. Such deposit may be replaced by a letter of guarantee from any approved Bank in Iraq. Tenders must be submitted to the Development Board (Directorate General of Legal Affairs and Contracts), Ministry of Development, Baghdad, in sealed envelope marked "Tender for supply of narrow gauge railway equipment" on or before 12 noon local time on *28th February 1957*. If sent by post, the tenders shall be registered, but tenderers must assure themselves of delivery to the Board by the due time. Tenders not submitted within the time specified or not accompanied by a receipt of the deposit or a letter of guarantee and Certificate of Membership of a Chamber of Commerce shall be neglected. The Board does not bind itself to accept the lowest or any tender. MINISTER OF DEVELOPMENT, BAGHDAD.

OFFICIAL PROPOSALS

Bids: February 11, 1957

City of Fort Lauderdale, Florida

NOTICE TO BIDDERS

Sealed bids will be received until 11 o'clock A.M., EST, February 11, 1957, in the City Commission Room, Fort Lauderdale, Florida for

SECTION I — SIX WELLS AND PUMPING STATIONS
SECTION II — RAW WATER MAINS
SECTION III — WELL FIELD ELECTRICAL DISTRIBUTION AND APPURTENANCES

Bidding blanks may be obtained from the office of the City Engineer. Plans and specifications are on file in the office of the City Engineer.

A deposit of $25.00 for plans and specifications, and of $25.00 each for additional copies of plans or specifications, will be required. All deposits for plans and specifications will be refunded upon their return in good condition within ten (10) days of the opening of bids.

A certified check for 2% of the total amount of the bid, made payable to City of Fort Lauderdale, Florida, shall accompany each proposal as evidence of good faith and responsibility of the bidder. This check shall be retained by the payee as liquidated damages should the bidder refuse or fail to enter into a contract with the payee for the execution of the work embraced in the proposal, in the event the proposal of the bidder is accepted.

The City reserves the right to reject any or all bids.

W. J. Veeder, City Manager

Bids: February 11, 1957

Reconstruction of Sewers

VILLAGE OF ENDICOTT
POLLUTION ABATEMENT PROGRAM
RECONSTRUCTION OF
HARRISON AVENUE SEWERS
NOTICE TO BIDDERS

1. Sealed proposals for performing all work in connection with the Reconstruction of Harrison Avenue Sewers, are hereby invited and will be received by the Board of Trustees until 5:00 P.M. o'clock, Eastern Standard Time on February 11, 1957 in the Council Chambers, Village Hall, Endicott, New York and there publicly opened and read immediately thereafter.

2. The work will consist of providing all labor, materials, equipment and incidentals and performing all operations required for the construction, complete and ready for municipal operation, of the new Sewer Lines and Structures and the removal of existing sewer lines and structures and all related work, as specified.

3. Drawings, specifications, bidding and contract documents may be examined at the office of the Consulting Engineers, Leonard S. Wegman Co., Grand Central Terminal Building, New York 17, N. Y., or at the office of the Village Engineer at Village Hall and obtained from the latter at a deposit of $15 per set. Full refund will be made to actual bidders for return of each set in good condition within two weeks after closing date for receipt of bids.

4. Each bid must be accompanied by a Bid Security in the form of a certified check payable at sight to the Village of Endicott in an amount not less than Ten Percent (10%) of the amount of the total bid. Such Bid Security will be returned to all except the three lowest formal bidders within (30) days after the formal opening of bids, and the remaining Bid Securities will be returned within two (2) days after the Owner and the accepted bidder have executed the contract or if no contract has been executed within thirty (30) days after the date of opening of bids, upon demand of Bidder at any time thereafter, so long as he has not been notified of acceptance of his bid. If the Bidder to whom the contract is awarded does not execute the contract and furnish the required bond within fifteen (15) days after receipt of notice of award, the aforesaid Bid Security shall be paid to the Village of Endicott as liquidated damages.

5. The Village reserves the right to reject any or all bids, to waive any informality in bids received and to accept that bid which in its judgment best serves the interests of the Village.

BOARD OF TRUSTEES
By: C. Burdette Parkhurst, Mayor
December 26, 1956

Bids: February 5, 1957

Contract BP-150.003

ADVERTISEMENT
THE PORT OF NEW YORK AUTHORITY
BROOKLYN-PORT AUTHORITY PIERS
PIER 1
PILE LOAD TESTS

Sealed proposals for driving timber test piles and load testing new and existing timber piles at the site of Pier 1, to be constructed at the Brooklyn Port Authority Piers, will be received at the office of the Chief Engineer of The Port of New York Authority, Room 1100, 111 Eighth Avenue, New York 11, N. Y., until 2:30 P.M. on Tuesday, February 5, 1957, at which time said proposals will be opened and read in Room 1108.

Contract documents may be seen at the office of the Engineer of Design of the Authority, Room 1115, and copies will be furnished upon request. No deposit will be required but the documents shall be returned in good condition not later than forty days after the opening of proposals.
THE PORT OF NEW YORK AUTHORITY
Donald V. Lowe, Chairman
New York, January 24, 1957.

Official Proposals Columns

of ENGINEERING NEWS-RECORD

are MUST reading, each week, for contractors, engineering-construction companies, equipment and materials manufacturers, all over the United States.

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Official Proposal Division
ENGINEERING NEWS-RECORD
New York 36, N. Y.

OFFICIAL PROPOSALS

Bid: February 19, 1957

Contract LGA-290.001

ADVERTISEMENT
THE PORT OF NEW YORK AUTHORITY
LA GUARDIA AIRPORT
TAXIWAY AND HOLDING PADS

Sealed proposals for the construction of a taxiway and holding pads and the furnishing and installation of utilities at La Guardia Airport will be received at the office of the Chief Engineer of The Port of New York Authority, Room 1100, 111 Eighth Avenue, New York 11, N. Y., until 2:30 P.M. on Tuesday, February 19, 1957, at which time said proposals will be opened and read in Room 1108.

Contract documents may be seen at the office of the Engineer of Design of the Authority, Room 1115. Documents will be furnished upon deposit of $30.00 per set for not more than three sets to any one company (each set including one copy of the contract drawings). Additional sets will be furnished upon payment of $30.00 per set, which payment is not returnable. Deposits and payments shall be delivered to the Treasury Department, Room 1001, where a receipt in duplicate will be issued. A copy of the receipt shall be delivered to Room 1115, where the documents will be furnished.

Those who have submitted a bid on the contract will receive a refund of the deposit for each set of documents, not exceeding three, returned within forty days after the opening of proposals. Those who have not submitted a bid will receive a refund of one-half of the deposit for each set of documents, not exceeding three, returned within forty days after the opening of proposals.

THE PORT OF NEW YORK AUTHORITY
Donald V. Lowe, Chairman

New York, January 24, 1957.

Prequalification Date: January 30, 1957

Board of Education
Bureau of Construction

Notice Re: Prequalification forms for Contractors. NOTICE IS HEREBY GIVEN THAT the Superintendent of School Buildings, Bureau of Construction, 4th Floor, Room 407, 42-15 Crescent St., L.I.C. 1, New York, will receive applications for prequalification of bidders from Contractors who may wish to submit bids for the proposed hereinafter specified contracts, as follows:

Furnish, deliver and install Item No. 1 — Heavy Kitchen & Cafeteria Equipment, Item No. 2 — Cabinet and Special work in Cooking Rooms & Home Living Center in the new J.H.S. 61, New York, Ave. between Empire Boulevard and Sterling Street, Brooklyn.

Prequalification application forms will have to be secured and must be submitted to the Superintendent of School Buildings, Bureau of Construction office, 4th Floor, Room 407, 42-15 Crescent Street, L.I.C., New York.

Bids when advertised will be received from prequalified bidders only.

Time for submitting prequalification application by contractors not now on file will expire on Wednesday, January 30, 1957.

WILLIAM H. CORREALE
Superintendent of School Buildings
Design and Construction

Dated: January 15, 1957.

Bids: February 26, 1957

City of Detroit, Michigan

ADVERTISEMENT
FOR
CONSTRUCTION AND SINKING OF CAISSON
FOR THE
RAW WATER BOOSTER PUMPING STATION
AT WATER WORKS PARK
AND OTHER WORK
FOR
DEPARTMENT OF WATER SUPPLY
CITY OF DETROIT, MICHIGAN
CONTRACT NO. SE-2

Sealed proposals for constructing and sinking caisson for the Raw Water Booster Pumping Station at the Water Works Park Station and other work will be received by the Board of Water Commissioners of the City of Detroit, Michigan. Proposals shall be addressed to the Board of Water Commissioners, City of Detroit, Room 506, Water Board Building, 735 Randolph Street, Detroit 26, Michigan and shall be endorsed "Proposal for Contract No. SE-2". Proposals will be received until 2:00 p.m. Eastern Standard Time, February 26, 1957, at which time they will be opened and read aloud in the Board Room, Fifth Floor, Water Board Building, 735 Randolph Street, Detroit 26, Michigan.

The work consists of the construction of a reinforced concrete caisson, circular in plan, having an outside diameter of one hundred eight feet (108') and wall thickness of seven feet (7'), and sinking to a depth approximately 97 feet below the existing ground surface; construction of a caisson bottom seal slab; construction of fourteen feet (14') diameter water conduits leading into and out from caisson to stubs in existing raw water tunnel; revisions in shafts at the above-mentioned stubs; revisions in Shore Well at Water Works Park and revisions in Raw Water Tunnel Junction Chambers at Pennsylvania and Forest Avenues, and other work as specified. The location of the bulk of the work will be in Water Works Park, 10100 East Jefferson Avenue, in the City of Detroit.

The Contract Documents, including the Notice to Bidders, the Forms of Proposal and Agreement, the Specifications and the Contract Drawings may be examined during business hours at the office of the Department of Water Supply, Room 706 Water Board Building, Detroit, Michigan. The Contract Documents may be obtained by making a deposit of Twenty-Five Dollars ($25.00) per set, which sum will be refunded upon the return of the complete Contract Documents in good condition within thirty (30) days after the bid date or if used in making a bona fide proposal.

As security for the acceptance of the Contract, each proposal shall be accompanied by a certified check in an amount not less than five per cent (5%) of the total lump sum price bid, drawn payable to the City of Detroit, Board of Water Commissioners, or a satisfactory bid bond executed on the form provided in the Proposal which will hold and firmly bind the bidder and his surety unto the Corporation of the City of Detroit in the full amount of five per cent (5%) of the total lump sum price bid.

No proposal may be withdrawn for at least 60 days after the scheduled closing time for receipt of bids.

The Board of Water Commissioners reserves the right to waive any informality in any bid and to accept any bid, or to reject any or all bids, should it deem it to be in the best interests of the City of Detroit to do so.

CITY OF DETROIT
BOARD OF WATER COMMISSIONERS
Oscar A. Wagner, President
George A. Shaffer, Vice-President
Alfred J. Simpson
Harvey A. Wagner
G. Remus, Superintendent,
General Manager and Chief Engineer
F. J. Pipp, Secretary

U. S. Government

Department of Commerce, Bureau of Public Roads, January 16, 1957. SEALED BIDS will be received at the office of the Regional Engineer, Bureau of Public Roads, 1440 Columbia Pike, Arlington, Virginia, until 11:00 a.m., E.S.T., FEBRUARY 14, 1957, for Project IA13, George Washington Memorial Parkway, Fairfax County, Virginia. 1.590 miles grading, draining, and other work from Leesburg Road to Federal Area at Langley. The approximate quantities of the more important items are: 70 acres Clearing and Grubbing, 662,000 cu. yd. Excavation, 1,700 cu. yd. Concrete, 230,000 lb. Reinforcing Steel, and 10,130 lin. ft. Concrete Culvert Pipe. Minimum wage rates have been fixed as required by law. Plans, specifications and proposal forms are available upon request at the address given above. H. J. Spelman, Regional Engineer.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specification No. IC-1857) will be received at Albuquerque, New Mexico, until February 26, 1957, for furnishing labor and materials for Channelization of the Rio Grande, Espanola Area, Black Mesa to Espanola, Middle Rio Grande Project, New Mexico, Location Espanola, New Mexico. Principal items are 256,000 cu. yds. excavation for floodway channel and diversion ditch; clearing about 12 miles of channel; 4,500 cu. yds. of groin embankments; and other work. Completion time 180 days. For particulars, address Bureau of Reclamation, P. O. Box 252, Albuquerque, New Mexico; or Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer.

OFFICIAL PROPOSALS

Bids: February 5, 1957

New Jersey Turnpike Authority

CONTRACT NO. PE-8

Proposals are invited for Contract No. PE-8 which involves landscaping of the Pennsylvania Extension of the New Jersey Turnpike in Burlington County, together with the maintenance and guarantee of new and existing landscaping at such location for specified periods.

Proposals will be received at the New Jersey Turnpike Authority, Administration Building, New Brunswick, New Jersey until 11:00 o'clock, Eastern Standard Time, on the morning of February 5, 1957, at which time and place said proposals will be publicly opened and read.

Bidders must submit with their proposal a Contractor's Financial and Equipment Statement.

Contract Documents may be examined during office hours on or after January 14, 1956, at the office of Alfred Geiffert, Jr., 101 Park Avenue, New York, New York, and at the office of the New Jersey Turnpike Authority, Administration Building, New Brunswick, New Jersey. Contract documents will be furnished upon payment of Ten Dollars ($10.00) for each set, upon application to the Authority. The payment will not be refunded and contract documents are not required to be returned.

NEW JERSEY TURNPIKE AUTHORITY
Paul L. Troast, Chairman

January 10, 1957

Many contractors depend entirely upon the

OFFICIAL PROPOSAL COLUMNS

of

Engineering News-Record

for Opportunities to bid. They might not see your announcements if printed elsewhere.

You undoubtedly want their bids on your contracts. Make sure of them on your next contract.

The cost is only $2.10 a line per issue.

EMPLOYMENT OPPORTUNITIES

DISPLAYED

The advertising rate is $31.50 per inch for all advertising appearing on other than a contract basis. Frequency rates quoted on request.

An advertising inch is measured 7/8" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

——RATES——

UNDISPLAYED

$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Position Wanted ads take 1/2 of above rate.
Box Numbers—count as 1 line
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Not subject to Agency Commission.

Send NEW ADS and Inquiries to Classified Advertising Division of ENGINEERING NEWS-RECORD
P. O. Box 12, N. Y. 36. February 7th issue closes January 28th

REPLIES (Box Nos.): Address to office nearest you
c/o This publication Classified Ads Div.
NEW YORK P. O. Box 12 36
CHICAGO 520 N. Michigan Ave. 11
SAN FRANCISCO 68 Post St. 4

POSITIONS VACANT

Civil Engineer-Estimator: for Industrial construction. Approximately 10-15 years of both estimating and job experience. Salary open, position permanent. Located Tri-Florida. P-3612, Engineering News-Record.

Civil Engineers for design and construction of municipal and industrial sewerage, treatment and water supply projects. Old established consulting firm in Midwest has openings in permanent staff. Please send full information and references. P-2830, Engineering News-Record.

Office Engineer and Assistant Engineer (two positions), desired for progressive Class 1 New England Railroad. Immediate placement for men with proper qualifications. State age, references, experience, education, salary required, when applying. All correspondence confidential. P-3730, Engineering News-Record.

Soils Engineer—prefer man with MS in soils about 1953 or 1954 to head up design group in a firm of consulting engineers specializing in design of dams. Must be top-notch design engineer and supervisor. Salary open. Location Midwest. P-2912, Engineering News-Record.

Assistant to Chief Engineer: Unusual opportunity for qualified man with firm of consulting engineers in Pa. Candidate must be thoroughly experienced in design of highways, bridges and related structures and capable of directing staff. Please submit experience resume, references, salary requirements and availability. P-3013, Engineering News-Record.

Design Engineer with estimating experience to join organization of general contractor specializing in heavy industrial and commercial work in expanding Ohio valley area. State experience, age, salary requirements, references, and date available. Seabright Construction Co., 1201 Wood St., Wheeling, W. Va.

Wanted . . . Heavy Construction Road Superintendent to work for long established New England contracting firm operating in New York and New England. Salary commensurate with experience and ability. P-3065, Engineering News-Record.

Estimators—General Construction! Graduate Engineers, under 30, some experience, military active duty completed. Reply in full with references, recent photograph and salary required. Bandlinger & Sons Const. Co., Inc., Box 2033, Wichita, Kansas. Phone AMherst 58101.

When Answering
BOX NUMBERS...
to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

POSITIONS VACANT

Wanted Superintendent or Engineer experienced for sheeting and shoring on water and sewer lines. Immediate placement. State full details of background and salary desired. P-3069, Engineering News-Record.

Graduate Civil Engineers not over 30 and preferably single. Must have military training completed and interested in the building construction business, starting in the field. We offer opportunity for rapid advancement to ambitious, hard-working young men willing to accept responsibility. Starting salary $70.00 per week if experienced with higher wages for those with some experience. Send complete history data. Martin K. Eby Construction Co., Inc., 610 N. Main, Wichita 2, Kansas.

Permanent position available recent graduate or experienced engineer capable visualizing, designing, drafting, costing, building and equipment, and production line layouts of four plant upstate New York canned food processors. Write P-3061, Engineering News-Record stating resume education and experience.

Construction Superintendent: For firm engaged in heavy construction mostly highway structures and bridges. Permanent position for experienced man capable of complete field responsibility including layout, organizing construction crews and coordinating subcontracts. Salary $12,000. Advance as justified by performance. First job 18 months in New York City (most contracts in New York and bordering states). Write full qualifications, age and when available. P-1075, Engineering News-Record.

Permanent position available Engineer capable visualizing, designing, drafting, costing, building and equipment, and production line layouts of four plant upstate New York canned food processor. Write P-3105, Engineering News-Record stating resume education and experience.

Master mechanic, superintendent, and young engineer wanted for well established organization specializing in foundation work in Eastern and Southeastern regions. Experience in cast-in-place concrete pile equipment and installation necessary. Fine opportunity for long-term employment for qualified personnel. Replies held strictly confidential. Send to P-1058, Engineering News-Record.

Construction Engineers: Contractor for large Dam Project on St. Lawrence Seaway has several openings in office and field for varied and interesting work. Immediate placement. State age, experience, education, and salary required. Reply P-1027, Engineering News-Record.

We have permanent openings for several structural and highway designers on highways in states west of Mississippi. Location Nebraska. Salaries open, depending on experience and ability. Excellent living and working conditions. Paid vacation, sick leave, hospitalization and medical, life insurance. Please state full particulars regarding personal, education and experience history in application letter. P-3087, Engineering News-Record.

Estimator-Engineer for general contractor in Westchester Co., N. Y. Experienced in estimating—sewer work, water, storm drainage, excavations, roads, etc. Must be top notch in both estimating and job experience. Give age, experience, references, and salary desired. Frank Bracalello, Inc., 722 Montgomery St., Scarsdale, N. Y.

Wanted: Grade Foreman, carpenter foreman, and mechanic for road and bridge construction. Work in Central N. Y. State. Experience-references. P-3069, Engineering News-Record.

SELLING OPPORTUNITIES OFFERED

Sales Representative to sell patented concrete forming system to residential and general contractors. Presently living in the Chicago area. To take over established midwest (5 state) area. Generous commission with drawing account based on requirements and ability. Must have general contracting or engineering background. Reform Corporation, 15100 W. 8 Mile Road, Detroit 35, Michigan.

Old established Brazilian Company, acting as manufacturers' representatives selling on own account and otherwise, seeks first class exclusive representation in Brazil for bituminous machinery (Asphalt Plants and Pavers, Road-Rollers and Motor-Graders). Letter to Avacomex Comercio e Importacao S. A. Av. Beira Mar, 200, Rio de Janeiro, Brazil.

EMPLOYMENT SERVICES

Salaried Positions $6,000 to $35,000. We offer the original personal employment service established 16 years. Procedure of high standards individualized to your personal requirements. Identity covered. Particulars—R. W. Bixby, Inc., 559 Brisbane Bldg., Buffalo 3, N. Y.

POSITIONS WANTED

Civil Engineer SM—MIT 10 years in design and hydro and chemical plant construction. Now in Jamaica. Available May. PW-3861, Engineering News-Record.

Construction Superintendent past 2 1/2 years on lump sum government work for Philadelphia General contractor desires job. PW-3811, Engineering News-Record.

Structural Engineer, graduate, licensed. 30 years experience in design and construction, subways, industrial buildings, waterfront, etc., available for responsible position. PW-3867, Engineering News-Record.

Superintendent, heavy & bridge construction. 20 years experience, bid to completion, $50m. PW-3901, Engineering News-Record.

Superintendent-Project Manager. Heavy construction all types 16 years experience. Cost and equipment conscious. Will relocate. PW-3960, Engineering News-Record.

Structural Engineer—MASCE. BS. NY License, over 20 years in design and construction. Proven administrative ability. Fully qualified to supervise the design of industrial buildings, bridges and other structures. Available in 30 days. PW-3981, Engineering News-Record.

Construction Management. Engineering background. Experienced in all types of const. work. Project manager, office manager, supervision, and estimating. 30 years experience, licensed P.E. Large industrial to housing projects held or office. Age 53. PW-3920, Engineering News-Record.

Civil Engineer, California License, many years varied design experience mainly on commercial and industrial projects. Desires position in Los Angeles area. PW-3957, Engineering News-Record.

Construction Executive sound experience all phases, bid to completion, buildings and heavy construction, available as project manager, chief estimator or similar position where scope and volume require top man. Now employed. Minimum $15,000. PW-2906, Engineering News-Record.

(Continued on following page)

Expansion of GENERAL FOODS

Creates the following Openings:

1 ESTIMATOR

BS degree with some experience, to make takeoffs for preliminary and engineering estimates and to price material, equipment and labor costs.

2 ARCHITECT

BS degree with 5 years experience. Work will include planning and design of industrial food plants.

These are permanent positions in a field uninfluenced by world or economic conditions. General Foods new executive office is in suburban White Plains just 30 minutes from New York City.

Please send resume with salary requirements to:

Mr. J. J. Conaty

GENERAL FOODS CORP.

250 North St.
White Plains, N. Y.

BECHTEL

AREA ENGINEERS
SENIOR ENGINEERS

Foreign Employment
Saudia Arabia or Sumatra

Field Engineers with refinery or related construction experience

Office Engineers with heavy industrial construction experience in planning, estimating, costs, material takeoff, scheduling

No Family Housing

Send resume to:
Manager of Employment & Placement
Industrial Relations Division

BECHTEL
Engineers, Builders for Industry
220 Bush St. San Francisco, Calif.
Recruiting Offices in New York, Los Angeles, San Francisco and Houston

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ENGINEERS - DESIGNERS - DRAFTSMEN

for work on

BRIDGES AND EXPRESSWAYS

Opportunity for continuous employment in our Louisville, Chicago, Cincinnati or Lansing offices for graduates or engineers with practical backgrounds. Overtime allowance, vacation time and insurance and retirement plan.

Please give detailed personal and experience record, three competent references and salary expected in first letter.

Hazelet & Erdal, Consulting Engineers
COMMERCE BLDG.
LOUISVILLE, KENTUCKY

HYDRAULIC ENGINEERS

Engineering graduates needed for California's growing water development program.

The work is challenging, interesting and of long range. It includes design and construction of big dams, power plants and statewide aqueduct system; water quality and flood control, and research.

The positions are open to recent college graduates in civil engineering. BSCE degree starts you at $436 a month with first raise in six months.

Promotional opportunities, on-the-job training, liberal vacations, generous retirement, and other State benefits.

For illustrated booklet and details write

C. S. Warner, Supervisor, Section H
State Personnel Board
801 Capitol Ave., Sacramento, California

POSITIONS WANTED
(Continued from preceding page)

Engineer Architect representative; General Superintendent or project manager experienced in Air Field, commercial buildings, industrial and chemical plant construction; also highway, grading and drainage. Available on short notice for assignment domestic or overseas. PW-3983, Engineering News-Record.

Inspection Service. General Construction. PW-3918, Engineering News-Record.

Construction Executive-project manager, chief engineer, superintendent, wide experience with contractors and engineers on domestic and foreign work. Have handled most types of construction. Over twenty years as superintendent, project manager, project engineer, chief engineer. Been in present position five years. Desire change for good reasons. Location immaterial. For full particulars write PW-3956, Engineering News-Record.

Superintendent Engineer—20 yrs experience- all types roads-excavation-structures-sewer & water lines. PW-3915, Engineering News-Record.

Canadian Civil Engineer (McGill '26), specialized in municipal problems, seeks a permanent responsible position with a municipality or private concern, located in the Southern States. Excellent administrative, professional and personal background. Now employed as a free-lance municipal consultant. 54 years old. Member of the Corporation of Professional Engineers of Quebec. Full details on request. PW-1003, Engineering News-Record.

General Manager Executive. Heavy construction diversified foreign and domestic experience includes joint venture management of all phases: finance planning, engineering and construction supervision: dams, tunnels, shafts, airbases, railroads, Power Plants, Bridges etc. PW-1061, Engineering News-Record.

Sales Engineer: Experienced in specification work with architects and engineers and sales to utilities, contractors, industrials, etc. Well acquainted Eastern Pennsylvania, Southern New Jersey, Delaware and Maryland. Have serviceable car. PW-1064, Engineering News-Record.

Construction Supervisor (Mechanical) age 30 thoroughly experienced in the construction of steam heating, circ. hot water heating, sprinkler systems (wet & dry), pump houses, refrigeration, domestic plumbing etc. Desire a responsible position in Europe. Have completed two Foreign contracts. PW-3993, Engineering News-Record.

Highway Engineer desires to join small established engineer or architect-engineer firm not now actively engaged in highway engineering with object of building this phase of work into a successful enterprise. Registered four states now and can obtain registration anywhere. Experience both field and office in building an organization and training men. Age 37. PW-1006, Engineering News-Record.

Construction Supt Eng. 30. BSCE. reg. P.E. in N. J. Experience in bldgs, road, pipeline and bridge construction. Married. Resume on request. PW-3997, Engineering News-Record.

STRUCTURAL DRAFTSMEN

FOR HIGHWAY BRIDGE WORK

In New York City and New Jersey

BROWN & BLAUVELT

468 Fourth Avenue, New York City

44 Cooper Street, Woodbury, New Jersey

POSITIONS WANTED

Heavy Construction Supt.—17 yrs. exp.- bridges, earthwork, sewers, highways. Desires permanent position in Florida. Must give present employer 30 days notice. PW-1021, Engineering News-Record.

Gen. Supt. 25 yrs heavy on concrete foundations bldgs bridges highways desire Eastern Territory but will travel. PW-1041, Engineering News-Record.

Administrative Construction executive—44— BSCE—P.E. license. 20 years experience. Estimate to completion on private and government projects—contract negotiation—reports. Chicago area. PW-1037, Engineering News-Record.

Civil Eng. 33. 8 years highways and electrical utility bidding, construction, and maintenance. Available as construction manager or chief engineer, etc. with permanence and future. Salary requirements $900.00 per month. PW-1028, Engineering News-Record.

Construction Engineer. 26. single. B.S. in C.E., certificate in industrial management. 4 yrs. estimating and supervision in heavy construction, paving & sewers, desires overseas position. PW-1031, Engineering News-Record.

Engineering Executive desires locate North Jersey Registered P.E.—Corporate officer with outstanding metropolitan firm—25 years successful top management experience in large scale general contracting. Seeks full or part time association or owner interest in growing company. Also available as consultant. Write to PW-1065, Engineering News-Record.

Civil Engineer P.E.N.Y. design. specs. reports. estimates, water, sewer, grading, drainage, pavements, highways, waterfronts, industrials, airports, military. Temporary Foreign assignment considered. PW-1055, Engineering News-Record.

Project manager and estimator. 33. MCE. PE 6 yrs. experience schools, sewage disposal plants, industrial bldgs., etc., full charge bid to completion; 2 yrs. port works design. Desire responsible position with contractor, preferably in heavy construction. New England area. Available February 15. PW-1046, Engineering News-Record.

Construction Superintendent: Graduate Civil Engineering and Business Administration, 6 years construction supervision, 1 year design chemical and industrial plants. PW-1045, Engineering News-Record.

Construction Superintendent: 25 years experience, field supervision, constructing industrial, commercial, institutional bldgs; large scale housing, churches etc. Desires similar position with reliable organization; can travel. PW-1049, Engineering News-Record.

Structural Steel and Miscellaneous Iron Estimator with managerial experience. Desires position with reliable company. PW-1051, Engineering News-Record.

Chief Draftsman. All types structural steel and miscellaneous iron, 14 years experience. Excellent references. PW-1052, Engineering News-Record.

SELLING OPPORTUNITIES WANTED

Engineer, retired, own office, will sell to builders, contractors, architects. RA-3927, Engineering News-Record.

Caribbean based engineering organization, interested in representing lines of Engineered products. Staff of 30. Contacts with Government officials and leading industrials throughout area. RA-3978, Engineering News-Record.

NEW POSITION

Cincinnati Sewage Disposal

Superintendent

Mill Creek Sewage Works:

Salary range, $7830 to $8613 a year. Supervise plant operation of 129 mgd capacity plant, now under construction. Modified primary treatment, separate sludge digestion with sludge disposal. Must have four years experience in sewage plant operation, engineering degree, be able to qualify for Ohio P. E. and Class "A" operator's license. Management ability essential.

Liberal employment benefits, retirement plan.

Apply before APRIL 1, to:

CIVIL SERVICE COMMISSION
260 CITY HALL
CINCINNATI 2, OHIO

BRIDGE ENGINEERS

DESIGNERS. DRAFTSMEN. Pleasant working conditions. Paid vacation, sick leave, hospitalization, life insurance. Interesting work on long range program. Vacancies in Orange, New Jersey, and Harrisburg, Pennsylvania.

BERGER ASSOCIATES, INC.
Second & Locust Sts. Harrisburg, Pa.

PROJECT MANAGER

Spanish speaking for large operation in San Juan, Puerto Rico. Prefer engineer with knowledge of heavy construction and pile driving experience in Puerto Rico. Age 35-45. Reply:

P-3928—Engineering News-Record
Class. Adv. Dept., P.O. Box 12, N.Y. 36, N.Y.

TOWNSHIP ENGINEER

Full time Township Engineer for Bridgewater Township, New Jersey, Somerset County. Must have P.E. license in New Jersey. Supervise township engineering functions, road maintenance, building inspector, plumbing inspector. Township of 14,000. Pleasant rural living. Salary open.

Reply with resume to Township Clerk,
Bridgewater Municipal Building
RD 5, Somerville, New Jersey

RECENT GRADUATES

with structural ability to design or modify standard designs of steel buildings for industrial and commercial use. Expansion program underway offers very good advancement possibilities in design and sales. Permanent positions in pleasant Midwestern town. Send complete resume, with salary thinking.

P-3872 Engineering News-Record
520 N. Michigan Ave., Chicago 11, Ill.

SPECIFICATION WRITER

ARCHITECTURAL

Excellent opportunity with nationally known manufacturer, located in the midwest. Send resume, stating education, experience, and salary expected.

P-3970, Engineering News-Record,
520 N. Michigan Ave., Chicago 11, Ill.

HIGHWAY ENGINEERS
DESIGNERS

FOR OFFICE WORK IN ST. LOUIS ON HIGHWAYS EXPRESSWAYS AND ASSOCIATED CIVIL WORKS

- *Permanent employment for qualified men*
- *Ample opportunity for advancement based on merit*
- *Generous transportation & moving allowances*

Plus Employee Benefit and Retirement Plan, Paid Vacations, Holidays, Sick Leave. Blue Cross available.

PLEASE WRITE FULLY TO OR INQUIRE AT

SVERDRUP & PARCEL ENGINEERING CO.

1134 LOCUST ST. ST. LOUIS 1, MO.

Highway & Bridge Engineers
Designers & Draftsmen

Career opportunities for men interested in professional recognition.
Excellent working conditions and employee benefits including liberal retirement program.
Openings in Pennsylvania, Maryland, Florida, Mississippi and overseas.

Air Mail Resume TO R. L. SHAW, *Personnel Director*

MICHAEL BAKER, Jr., INC.

BAKER BLDG. *Consulting Engineers* ROCHESTER, PA.

HIGHWAY ENGINEERS

Immediate Employment

Starting positions in California's highway expansion program. $436/mo. to start, with first raise after 6 months. Subsequent promotional opportunities to higher level positions. Open to recent college graduates in civil engineering. Write for illustrated booklet: C. S. WARNER, Supervisor, Section E, State Personnel Board, 801 Capitol Avenue, Sacramento 14, California.

STRUCTURAL DESIGNERS

FOR HIGHWAY BRIDGE WORK

SENIORS and JUNIORS

Work in New York City and New Jersey

BROWN & BLAUVELT
468 Fourth Avenue, New York City
44 Cooper Street, Woodbury, New Jersey

ENGINEERS

Long established firm of consulting engineers with world wide practice needs both beginners and experienced civil, electrical, mechanical, and foundation engineers for interesting work on large dams, powerplants, and river control works. Permanent positions. Liberal employee benefits. Starting salaries dependent on qualifications. Please send complete resume to Hugo Niemi, Personnel Manager.

HARZA ENGINEERING CO.
400 W. Madison St. Chicago 6, Ill.

ASSISTANT MANAGER

FIELD INDUSTRIAL CONSTRUCTION

A large, established firm in the Far West has a unique opportunity for a man to supervise field construction work at several locations, mostly heavy industrial construction, totaling hundreds of millions of dollars annually. Some travel required.

The man who qualifies should be 40 to 50 years old, and now engaged, or with recent experience, *in this type of supervisory work.*

He will receive a most substantial salary; an opportunity to work in a mild, sunny climate, near excellent schools, cultural and recreational facilities. There are outstanding company benefits, including retirement plan.

Here is an exceptionally good chance to move UP with a widely-respected company. Write in confidence to

Classified Advertising Division
P. O. Box 12, New York 36, N. Y.

McKEE NEEDS

- Structural
- Concrete
- Piping
- Mechanical

ENGINEERS

Our Metals, Refinery and Industrial Divisions offer you wide choice of opportunity to make full use of your talents, with excellent prospects for promotion to supervisory, staff and executive posts.

Broad diversification of work in our three engineering divisions assures you *permanent* security of employment.

You can build a strong foundation for your future with McKee. For complete information on the McKee organization and the extra benefits this company offers you write for our folder "The Key to Your Future" or contact us by telephone.

Telephone TOwer 1-2300, Cleveland, Ohio
or write to Edward A. Kolner
Arthur G. McKee & Company
2300 Chester Ave., Cleveland 1, Ohio

Arthur G. McKee & Company

Engineering offices in
CLEVELAND, OHIO • UNION, N.J. • TORONTO, ONT.

SUPERINTENDENT BUILDING CONSTRUCTION

Top flight man by growing company operating nationally. Give all pertinent data in reply including education, experience, salary, references and when available.

BLOUNT BROTHERS CONSTRUCTION CO.
P. O. Box 949 Montgomery, Ala.

HIGHWAY ENGINEERS

Well established consulting engineering firm located in small college community of Colorado is desirous of obtaining qualified personnel for permanent positions. Steady expansion of firms operations results in openings as follows:

One bridge engineer with previous experience in designing, supervising and coordinating staff of design engineers. Salary $7200 to $8400

One highway engineer with previous experience in designing, supervising and coordinating staff of design engineers. Salary $7200 to $8400

Three to five experienced highway structures and bridge design engineers. Salary $6000 to $7200

Three to five experienced highway design engineers. Salary $6000 to $7200

Send full resume of experience, date of availability and other pertinent data. All replies confidential if requested.

P-3813, Engineering News-Record,
520 N. Michigan Ave., Chicago 11, Ill.

CIVIL ENGINEERS
HIGHWAY DESIGNERS
STRUCTURAL DESIGNERS
DRAINAGE DESIGNERS

FOR HIGHWAY and BRIDGE WORK

SENIORS and JUNIORS

WORK IN RICHMOND, VA.

Send Resumes to

Blackburn, Brown & Blauvelt
728 East Main Street Richmond, Va.

STRUCTURAL

ENGINEERS
DESIGNERS
DRAFTSMEN

Prefer several years or more experience in any of these fields:

BRIDGES

BUILDINGS
EXPRESSWAYS
HYDRO PROJECTS
TEST FACILITIES*

Will consider lesser experience with good educational background, including several recent graduates to round out a planned expansion program. Occasional openings for combination field men. These are permanent additions to our regular staffs.

We are professional engineers engaged primarily in design which covers a wide scope of practice. The variety and unusual charater—for example, the proposed world's largest bridge project—offer excellent opportunity for professional development and advancement.

Immediate openings in our St. Louis general offices and occasionally in our San Francisco branch office. Confidential interviews can also be obtained at Washington, D. C., and Portland, Oregon.

Paid vacation, sick leave, holiday, overtime. Excellent Employee Benefits Plan provides retirement income plus life and disability insurance. Blue Cross. Moving allowance.

Please write fully, including salary data, to

SVERDRUP & PARCEL, Inc.

ENGINEERS — ARCHITECTS

915 Olive St. Louis 1, Mo.

*We are designers of the technical facilities for the Arnold Engineering Development Center, operated by our subsidiary, ARO, Inc

- **ASSISTANT PROJECT ENGINEER**
- **TWO SENIOR CIVIL ENGINEERS**
- **SENIOR STRUCTURAL DESIGNER**
- **TWO CIVIL ENGINEERING DRAFTSMEN**
- **TWO STRUCTURAL DRAFTSMEN**

For design of highways, bridges and airfields. Permanent employment with ample opportunity for advancement.

Suburban office in Orange, New Jersey
Liberal employee benefits.

Send full resume to

LOUIS BERGER & ASSOCIATES
177 Oakwood Ave. Orange, New Jersey

ENGINEERS WHO ARE "Thinking California"

Immediate assignments in our Los Angeles or San Francisco Divisions.

ELECTRICAL

Engineers, designers, and senior draftsmen with qualifying experience on petroleum refineries, chemical plants, petrochemical plants, central station steam power plants or other related projects.

MECHANICAL

Engineers with qualifying design or project experience on petroleum refineries, petrochemical plants, chemical plants, central station steam power plants or related projects.

PIPING

Designers and senior draftsmen with qualifying experience on high pressure, high temperature or process piping.

INSTRUMENT

Engineers with qualifying application experience on petroleum refineries, chemical plants, steam power plants or related projects.

Extra Benefits Include
Profit Sharing Trust &
Liberal Insurance Plan

Plus Excellent Relocation Allowances for you and your family

Recruiting offices in:
New York, Houston, Los Angeles, or San Francisco

BECHTEL

Engineers & World-Wide Builders for Industry

220 Bush Street

San Francisco 4, California

CIVIL ENGINEERS
for work in
SOUTHEAST ASIA

Personnel needed to complete technical party. Work involves design and supervision of construction of highways and bridges in South Vietnam. Duties include instruction of on-the-job trainees. High degree of initiative, judgment and skill in handling human relations required in addition to professional competence. All personnel must be experienced and able to provide references. Eighteen-month minimum employment contract. Housing furnished. Dependents authorized to accompany except in case of field personnel. Only those interested in difficult and challenging work should apply. The following positions are open:

Highway and Bridge Designers — **Draftsmen**
Highway Construction Engineers (Field) — **Secretarial**
Party Chiefs (Field)

The following listed personnel will be chosen from Engineers having a long and successful record of experience in responsible assignments. They will be assigned to assist the Government of Vietnam in organizing a Department of Highways in the Ministry of Public Works for the planning, administration, coordination and supervision of all highway activities and appurtenant services:

Highway and Bridge Engineers — **Materials Engineer**
Program and Planning Specialist

Openings also available for both field and office personnel at various stateside locations, in connection with the above and other important highway projects.

For Application Blank Write To:

CAPITOL ENGINEERING CORPORATION
Consulting Engineers
DILLSBURG, PENNSYLVANIA

ENGINEERS
Come South!

We have immediate openings for Engineers — Designers — Detailers — Draftsmen Civil — Highway — Structural — Traffic — Architectural — Mechanical — Electrical (Currently no field positions available) Company-paid hospitalization, life insurance and retirement. 40-hour week. Air-conditioned offices. Salaries $400 to $800, depending on education and experience. Permanent position. Excellent opportunities for advancement. Send complete resume of education and experience with salary requirement to:

PALMER and BAKER, INC.
P. O. Box 346 — Mobile, Alabama

CIVIL ENGINEER

Opportunity with the Service Company of a top electric utility for CE graduate under 30 with experience in design of transmission towers. Will work in engineering department. Offices in New York City. Good salary. Liberal benefits plan. Send resume to:

P-1013, Engineering News-Record
Class Adv. Dept. P.O. Box 12, N.Y. 36, N.Y.

SALES ENGINEER

A major steel company has need for sales engineer to promote and sell fabricated products in New England states. Excellent opportunity for man 25 to 30 years old with engineering background and a desire for sales work. Attractive starting salary with company car, expenses and bonus plan.

P-1808, Engineering News-Record
Class Adv. Dept. P.O. Box 12, N.Y. 36, N.Y.

HIGHWAY AND STRUCTURAL ENGINEERS - DESIGNERS - DRAFTSMEN

Several years' experience in highway or bridge design work preferred but not necessary if educational background is good.

This firm of Consulting Engineers is anxious to employ men who desire long range permanent work, who want to develop as professional engineers and who are eager to accept ever increasing responsibility.

Besides well developed training courses the company offers vacations and holidays with pay, sick leave, blue cross, free life insurance, overtime, moving allowance, and an employee profit sharing plan.

Positions in the above categories available in permanent company offices at Chicago, New York, San Francisco, Oklahoma City and Toronto.

Please reply giving experience record to:

DE LEUW, CATHER & COMPANY
150 NO. WACKER DRIVE — *Engineers* — CHICAGO 6, ILLINOIS

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES — **EQUIPMENT USED or RESALE**

UNDISPLAYED —RATES— *DISPLAYED*

$2.10 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads.

The advertising rate is $23.60 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS or Inquiries to Class. Adv. Div. of Engineering News-Record, P. O. Box 12, N. Y. 36, N. Y. February 7th issue closes January 28th.

MANUFACTURING FACILITIES AVAILABLE

THE ABOVE PLANT with over 150,000 square feet of manufacturing facilities near London, England is available to manufacture, on a royalty basis for the sterling area, equipment preferably for the construction industry.

All equipment for sheet metal pressed work, heavy plate work, etc. available. Write c/o Managing Director, presently in U.S.A., P.O. Box 125, Carlstadt, N. J.

WANTED

24" X 160 — 180 FT.

BELT CONVEYOR

IN GOOD CONDITION

ALSO ONE 1½ YD.

FRONT END LOADER

LOCATION OHIO

URGENT

W-3971, Engineering News-Record, 330 N. Michigan Ave., Chicago 11, Ill.

WANTED

300 to 500 tons of 5" 6" and 8" black steel pipe lapweld or seamless

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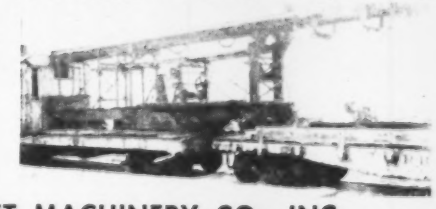

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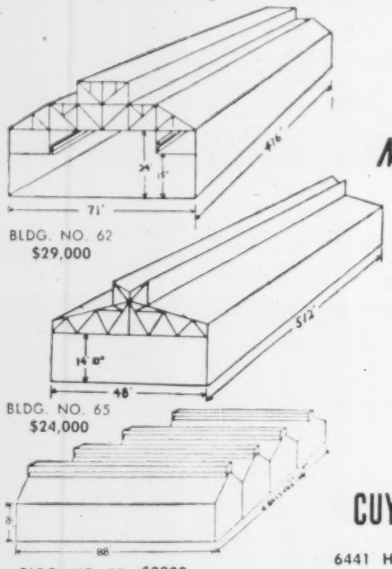

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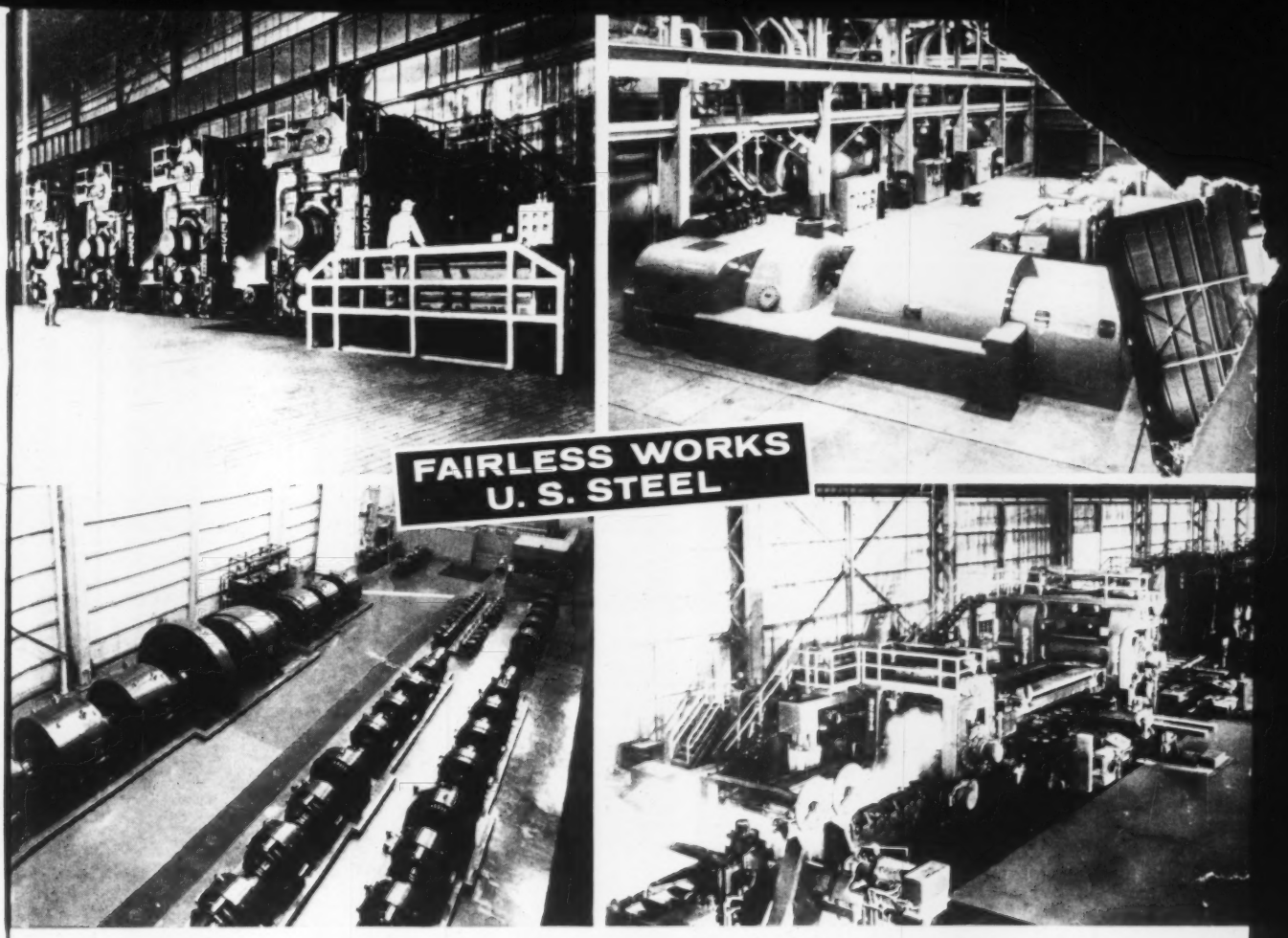

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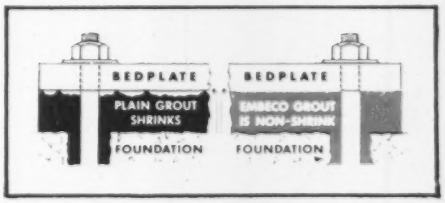

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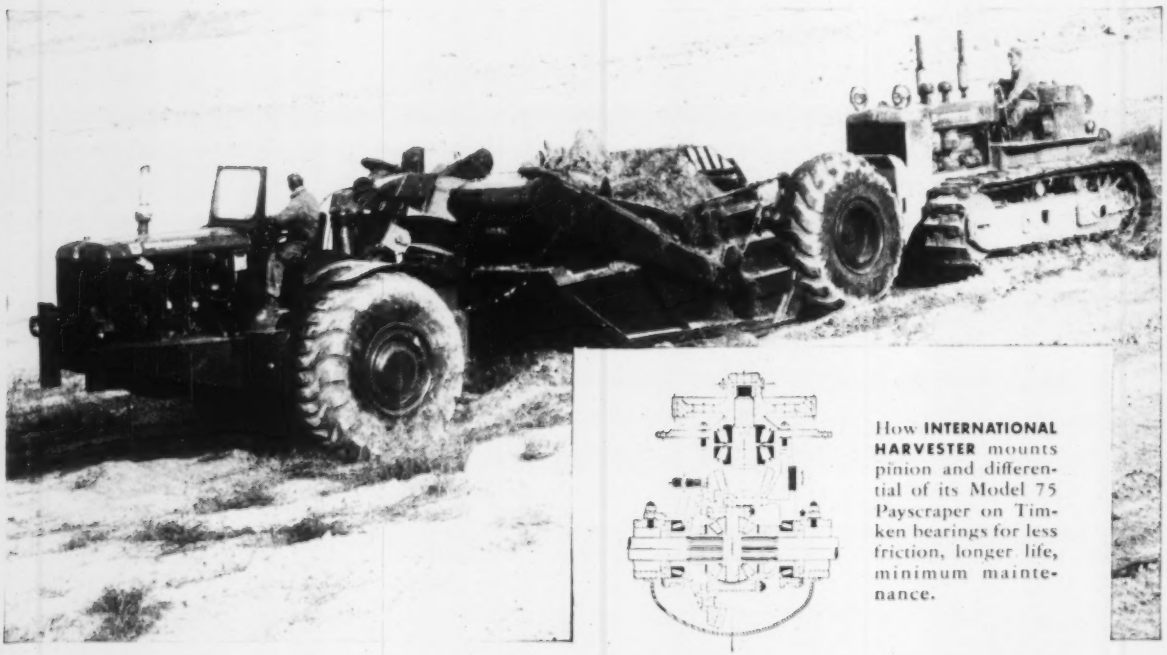

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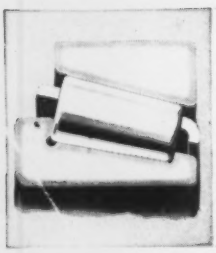

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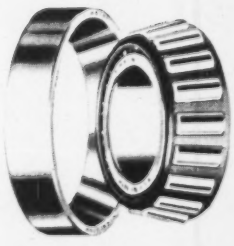

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